TIME ESTIMATION ABILITIES IN TYPE A AND TYPE B CHILDREN

By

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A DISSERTATION PRESENTED TO THE GRADUATE SCHOOL OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

UNIVERSITY OF FLORIDA

1984

ACKNOWLEDGMENTS

I would like to thank the staff, faculty, and particularly the students of Glen Springs Elementary School in Gainesville for their support and participation in this research project. Al Avendano, who helped me collect my data and keep a handle on the children, deserves special thanks. Additionally, I would like to thank my committee members for their helpful advice in the design and preparation of this study. Special mention goes to several very good friends who helped out in what often were turbulent times: Nan, Terry, and Carol, my partner in anxiety and purveyor of celebration "spirits." Thanks also go to Janice for our Thursday rendezvous, which helped me get through the longer weeks. Finally, special thanks go to Pat Miller, who often went above and beyond the call in helping through the last four years. She often showed less willingness to give up on me than I did. I have often wondered how the last four years would have gone if not for her. Thanks Pat!!

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Abstract of Dissertation Presented to the Graduate School of the University of Florida in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy

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August 1984

Chairperson: Patricia H. Miller
Major Department: Psychology

Time urgency or impatience factors have appeared on every scale of Type A/B behavior, regardless of the age of the population studied. Little research, however, has examined the relationship between time estimation and Type A behavior, especially in children. Forty-nine fifth and 41 third graders estimated the passage of one minute while sitting quietly, while reading or solving math problems under both a stress and no stress condition, and while reading sentences or solving math problems presented at a VI-5 and VI-10 second schedule. A Short Time Estimation Scale (STES) was developed to assess children's judgments of the length of time of common everyday events. The STES includes three subscales: 0-30 seconds, 0-6 minutes, and 0-60 minutes. Each item on the STES is scored on a 30 point Likert scale. The Matthews Youth Test for Health (MYTH) was used to classify subjects as Type A/B. It was hypothesized that a) Type A children would overestimate the passing of

time, i.e., believe a minute had passed before it really had; b) Type B children would be relatively accurate or would underestimate time; and c) Type A children would attempt more math problems than Type B children when not under stress, but performance would not differ when under stress. This study also tested two hypotheses concerning the STES. Finally, time estimation scores under the VI-5 and VI-10 conditions were compared to test Ornstein's theory of time estimation. Repeated measures ANOVAs examined sex, grade, and Type A/B effects on time estimation, number of problems attempted, and STES scores. The SAS RSQUARE procedure determined the best predictors of Type A. Results suggest that a) time estimation abilities are not fully developed in elementary school children, b) time estimation is not clearly related to an overall Type A/B personality in elementary school children, c) the impatience/aggression factor of the MYTH is more closely related to time estimation than is the total MYTH score, d) Ornstein's theory is more accurate for Type B than Type A children, and e) different predictors of the Type A behavior pattern emerge for the two grades.

INTRODUCTION

Coronary disease is the primary cause of death in America today, replacing tuberculosis at the top of the list of causes of adult mortality. Although coronary artery disease (CAD) and coronary heart disease (CHD) are most prevalent in late-middle and old age, the etiology of the diseases begins as early as the second decade of life when streaks of fatty tissues form along arterial, primarily the aortic, walls (Neufeld, 1974). Strong and McGill (1969) report that by the age of ten, aortic fatty streaks are present in most children. Similar streaks are present in the coronary arteries of nearly half of all 10-14 year olds. While at this stage such fatty deposits may be harmless, this is seen as a critical stage in the development of atherosclerosis (Strong & McGill, 1969). As a result, the medical community has been increasingly interested in identifying those factors in our life, or lifestyle, which may help predict future coronary disease. Following such identification, steps may be taken to reduce the influence of the risk factor. These intervention programs are increasingly being aimed at young people in an attempt to preclude the development of coronary disease in the first place. Thus far, a number of factors such as smoking,

hypertension, obesity, and high serum cholesterol have been recognized as being associated with an increased risk for heart disease (Neufeld, 1974). Physicians have begun warning their patients of these risks, all too often with little or no effect. However, at this point, our level of understanding suffers from two major problems.

First, our predictions based on the above factors, even in combination, are highly fallible. For example, two individuals may smoke similar amounts of tobacco, be equally overweight, suffer from mild hypertension, and have high cholesterol levels, yet only one, or perhaps neither, will develop coronary disease. Therefore, these factors, while useful, are not perfect predictors.

The second problem is that these factors are merely symptoms of another underlying problem; something is causing these symptoms to appear. While environmental factors undoubtedly play a role, especially in the case of obesity and cigarette smoking, other internally stimulated, or psychological, factors seem to be at least as important. The effects of stress, for example, have only recently been investigated, and have been found to have a marked influence on physiological functioning.

In the late 1950s, two cardiovascular specialists in the San Francisco Bay area, Ray Rosenman and Meyer Friedman, noticed that most of the patients they were treating for cardiovascular disorders had certain behavioral characteristics in common. Their patients seemed rushed for

time, highly competitive, and often hostile. These characteristics have since been collectively labeled Type A, or Coronary Prone behaviors, and have become the topic of a large volume of research from both the medical/physiology and psychology fields. This pattern is defined by Friedman and Rosenman (1975, p. 67) as "an action-emotion complex that can be observed in any person who is aggressively involved in a chronic, incessant struggle to achieve more and more in less and less time, and if required to do so, against the opposing efforts of other things or other persons" (emphasis added). Subsequent systematic research has confirmed the characteristics identified by Rosenman and Friedman: a) excessive achievement striving, b) a sense of time urgency, and c) hostility (Friedman & Rosenman, 1975; Glass, 1978). The Type B person, then, is the antithesis of the Type A, rarely or never exhibiting the above characteristics. In order to better conceptualize the Type A or coronary prone as well as the Type B/low risk person, it might be useful to examine each of these characteristics more closely.

Excessive achievement striving may be seen in several aspects of behavior of an individual displaying the coronary prone behavior pattern (CPBP). Status seeking and a "quest for numbers" are two major tendencies which may be observed (Friedman & Rosenman, 1975). The former refers to the individual's desire to obtain positions at work and in their social life which are associated with respect and power, as

in a promotion to a managerial position or election to office in a club or organization. Additionally, the pace of such success is of great importance to such individuals, motivating them to work long hours, weekends, and even to skip vacations in order to improve their chances for an increase in status. The latter characteristic, "quest for numbers," refers to the Type A individual's tendency to quantify success or achievements, as in the number of promotions or raises in a year, the number of publications or patents, the number of women dated or "scored" with, and particularly the accumulation of money, which may be personal or professional ("I just closed a two million dollar sale!").

The sense of time urgency may be seen in many Type A persons in various forms. Unreasonable deadlines may be set for various goals, and then reset even after failing to achieve their goal within the self-imposed time constraints. If by chance the time deadline is met, it is likely that the individual will then set an even shorter, less realistic deadline the next time. Type A persons often are those who do not "take time to smell the roses along the way"; they tend to rush from place to place, often trying to deal simultaneously with several problems or projects. As will be discussed later, this sense of time urgency may result in, or result from, a tendency to overestimate the passage of time, which then tends to increase the perceived need to complete tasks or goals within what may be an unrealistic time frame.

Hostility, commonly identified as "free floating" hostility (Friedman & Rosenman, 1975), is the third major characteristic of the CPBP. These behaviors may be seen in the individual who easily becomes angered by long lines in the store or bank, or by traffic jams. This may also be seen in the Type A's inability to engage in sports or activities simply for the enjoyment of participation. Rather, Type A's feel they must excel and win in virtually all activities in which they engage.

It should be noted that these are general characteristics, and an individual need not fit into all of these descriptive categories in order to be classified as Type A. Rather, a preponderance of characteristics is all that is necessary. For example, one Type A person may not display many, if any, of the hostility characteristics, but may live under a great sense of time urgency on the job where he or she has set the goal of being a senior vice-president by the age of 40. These characteristics alone may be quite sufficient to significantly increase the individual's risk of coronary disease.

Behavioral characteristics of adults in conjunction with solicited responses to questions have proven to be one of the best methods of classifying individuals as Type A or Type B. The Structured Interview, in which individuals are asked a series of questions and observed for behavioral signs of stress or impatience, is perhaps the most predictive measure of Type A behavior in adults (Rosenman,

1978). The behavioral scoring criteria include posture and behavior while waiting to be interviewed, stride when entering the interview room, gestures used in responses to interview questions, tendency to hurry the speech of the interviewer when the interviewer intentionally speaks slowly, and response to being interrupted by the interviewer. One of the most telling characteristics in the interview is the presence of loud, emphatic, often explosive speech.

These characteristics are present in the everyday behavior of Type A adults, not just in laboratory interviews. Indeed, as mentioned previously, it was the omnipresence of such behavior characteristics which originally alerted Rosenman and Friedman to the existence of Type A behavior pattern. High levels of job involvement, competitiveness at work and home, and a general sense of impatience dominate the behavior of these individuals.

The early body of evidence implicating Type A or coronary prone behavior with subsequent cardiovascular disease was correlational. A large number of researchers have since examined the problem of how behavioral or psychological characteristics are related to the observed physiological pathology. How such psychological tendencies eventually result in atherosclerosis or a myocardial infarction has become a major topic of research.

A large number of physiological differences between Type A and Type B people in reaction to stress have since

been noted, and are discussed in the next section. In general, it has been noted that Type A people tend to a) show an increase in secretion of ACTH, leading to a general autonomic arousal, b) excrete greater levels of catecholamines, c) exhibit increased levels of serum triglycerides, d) suffer from increased levels of cholesterol and fat which are also eliminated from the body more slowly, e) show an increase in blood clotting tendencies, and f) tend to have increased serum insulin levels (Friedman & Rosenman, 1975; Williams, Friedman, Glass, Herd, & Schneiderman, 1978). In other words, individuals displaying the Type A characteristics seem to be physiologically hyper-responsive to perceived stressors in the environment, resulting in a "fight or flight" response. Most importantly, the evidence indicates that Type A individuals are more likely to perceive situations as stressful than are Type B individuals, increasing the amount of time their body is under autonomic stress.

Of the physiological characteristics discussed above, several have previously been linked directly to an increased likelihood of the occurrence of CHD, such as myocardial infarction or atherosclerosis. First, increased levels of serum triglycerides and cholesterol have long been an identified causal factor in CHD. Low density lipoproteins (LDL) and very low density lipoproteins (VLDL), both of which contain high levels of cholesterol, are implicated in the deposition of atheromatous plaques along arterial walls.

Combine with this the slower elimination of cholesterol from the cardiovascular system, and the individual is at much greater risk. Yet a third factor then combines with these first two. With the blocking of arterial passages, there is an increased risk of blood clot formation, a tendency which, as noted previously, is also more common in Type A persons. This then increases the risk of thrombus. Guyton (1977) reports that of those individuals who die of arteriosclerosis, estimated to be the cause of half of all deaths in the U.S., two-thirds are the result of thrombosis. Finally, another factor, increased levels of catecholamines, results in an increase in the rate of intravascular deposition of clotting elements, as well as in the narrowing of capillaries. Arterial blood supply may then be affected, resulting in damage to the arterial walls. It becomes obvious that these risk factors interact to pose a serious threat to the Type A person.

All of these effects may be viewed as a direct or indirect result of sympathetic nervous system arousal. Several measures of autonomic arousal have lent themselves to relatively easy measurement in the laboratory setting. Three of these, heart rate, blood pressure, and serum triglycerides/cholesterol levels, will now be reviewed to a) support the contention that such autonomic responses are more pronounced in Type A than Type B people and b) to provide some indication as to the types of conditions under

which the Type A or Type B person will demonstrate such autonomic arousal.

AUTONOMIC AROUSAL AND TYPE A BEHAVIOR

Heart Rate (HR) Response

Herd (1978) has noted that short term physiological measures, such as heart rate, have been the most commonly utilized physiological responses in research on Type A/B behavior. As a result, there is a considerable body of evidence concerning differences in response patterns between Type A and Type B persons, and sex differences as well.

The level of challenge to the individual has been found to have differential effects on HR response in adult males. In a study by Dembroski, MacDougal, Herd, and Shields (1979), 84 male college students were administered the Structured Interview and the JAS Student Form for classification as Type A or B. The JAS Student Form yields three subscales: Type A/B, hard driving/competition, and speed impatience. Lead II electrodes monitored HR responses during two tasks: a cold pressor (CP) task (submersion of the right hand in a container of 4°C water) and a reaction time (RT) task requiring subjects to respond to the change of color of a light by pressing a telegraph key. The tasks were conducted under one of two conditions: a) high stress, in which subjects were told prior to the task that the task was difficult and would require a large amount of willpower to

succeed; or b) low stress, in which the task was described calmly as one that was easily completed by all individuals. This provided four groups for analysis: Low-B, Low-A, High-B, and High-A.

The HR response was found to be markedly higher for those in the high stress conditions in both the CP and RT tasks. In fact, stress level was more predictive of HR response than simple A/B typing. While the High-A group demonstrated the greatest HR increase (13.2 bpm on the CP task, and 4.2 bpm on the RT task), the High-B group had the second highest increase (7.1 and 1.0 bpm, CP and RT, respectively). The Low-A group exhibited the least reactivity in the CP task (4.0 bpm), less than the Low-B group (6.8 bpm). On the RT task, the Low-A group showed a greater HR decrease (-4 bpm) than the Low-B group (-2.4 bpm). Both Type A and Type B subjects in the high stress condition exhibited HR increases, with Type A's increasing an average of 4.2 bpm, and Type B's averaging an increase of 1.0 bpm. The deceleration in the case of the RT task (low stress condition) may be a result of the "taking-in" process described by Lacey and Lacey (e.g., 1974). Lacey and Lacey suggest that when an individual attends to a non-threatening stimulus, heart rate declines. They refer to this phenomenon as the "orienting response." The study strongly supported the hypothesis that Type A persons would be the most reactive to highly stressful events, but not necessarily to low stress situations. The authors

attributed this difference in reactions between Type A and Type B to a lower threshold for "perception of challenge."

Similar results have been obtained in a study (Pittner & Houston, 1980) in which subjects were administered forward digit span tests in three stress conditions: low (no threat), self-esteem threat (told they were responding too slowly), and shock threat (told that they might receive electric shocks for errors made on the tests). Again, Type A subjects exhibited higher HR levels than Type B's (85.28 and 81.92, respectively). This rate increased in Type A's as the stress condition increased. An interesting result found by these researchers was a significantly greater use of denial, i.e., Type A's reported lower subjective levels of negative affect than Type B's, despite being more responsive physiologically. It is suggested by these authors that such a mechanism indicates a greater likelihood for Type A's to attempt to actively cope with the situation.

In a later paper, MacDougall, Dembroski, and Krantz (1981) examined the effects of types of challenge on women. Previous research had indicated that the Type A pattern was predictive of CHD in women as well as men. Therefore the authors attempted to replicate these findings, and to determine whether or not women, as well as men, would show responses influenced by the level of challenge. Sixty female college students were exposed to cold pressor (CP) and reaction time (RT) tasks in a design very similar to Dembroski et al. (1979, discussed above). Unlike the

previous results for men, data indicated no Type A/B differences on any of the physiological measures. The HR on the RT task was, however, correlated with a clinical judgment labeled "Potential for Hostility." Unfortunately, the bases for this judgment are not discussed by MacDougall et al., making it difficult to draw conclusions from this relationship. A failure to compare the relative Type A/B scores between the women and men in these two studies also makes a comparison problematic.

Evidence existed, however, to lead the authors to suspect that the lack of significant results may have been due to the females not taking the tasks seriously. Several subjects apparently were seen to "chuckle" at the instructions and comment about the "silly" nature of the tasks. As a result, a second study was conducted in which subjects were administered a very difficult history exam, labeled "Well Known Facts of American History" in lieu of the CP treatment. This test was followed by the RT task, but this time subjects were offered monetary reward for successful and fast responses. Surprisingly, Type A females showed smaller increases in HR than Type B's. The authors, citing Lacey and Lacey (1970), conclude that Type A persons may have actually become more involved in the tasks, resulting in the subsequent lower HR. They also conclude that women are more motivated and concerned with tasks involving interpersonal exchanges than psychomotor tasks. Perhaps most important, this study, as one of relatively few

examining Type A behavior in women, indicates the need for much more investigation in this area to provide data on differences between the sexes in responsivity to various stressors.

A study by Jennings and Choi (1981) examined the effects of task levels on male business executives. Using the Structured Interview for categorization of Type A and B persons, 24 male volunteers were put through an auditory RT task (1900 vs 1420 Hz, 62 dB, 80 msec in duration). Using inter-beat interval (IBI) as a dependent measure, Type A subjects' IBIs lengthened (HR slowed) until onset of the stimulus, after which IBI shortened (HR increased). The initial deceleration was not found for non-Type A subjects. In addition, the variability of the HR response was greater for Type A's when reaction time was slow, but the converse was true when they reacted quickly.

In summary, there seems to be a large body of evidence, gathered from a broad cross-section of the population, that the heart rates of Type A individuals are more responsive (or reactive) to stress situations than are non-Type A's. Two factors serve to influence the degree of reaction, however. First, the level of challenge or stress seems to have differential effects, with Type A's being more physiologically responsive under high stress, but not necessarily any more reactive under lower levels of stress. Second, there appears to be a sex difference in the <u>types</u> of stressors which cause physiological arousal, as measured by

heart rate. Male, though no female, Type A's react to psychomotor challenge. Females seem more likely to respond to social or inter-personal challenges. Male reactivity to such stressors is, as yet, unknown. It should be remembered, however, that Type A behavior in females has been related to CHD, so exposure to ecologically valid or "real-life" stress may not duplicate the sex differences found in these laboratory studies.

Blood Pressure Measures

Perhaps the second most common physiological measure of arousal levels in studies examining Type A and Type B behaviors or personality has been blood pressure (both systolic and diastolic) changes in response to stress. Several studies to be discussed in this section were also in the heart rate review, since these measures commonly are made in the same studies. As in the heart rate section, an attempt has been made to provide research evidence from a diverse group of subjects.

Insel, Fraser, Phillips, and Williams (1981) examined some 1500 children, aged 10-16, attending either public school or Seventh-Day Adventist parochial schools in Britain. The authors chose the latter population for study due to their relatively low rate of coronary heart disease in adulthood. Several possible reasons for this lower risk level are discussed, such as their dietary behavior (no meat, alcohol, caffeine, etc.), and lower-than-average blood

pressure. Of course, this lower blood pressure may be the result of the dietary control. While numerous factors were examined in the study, for the purpose of this review, only those factors found to be related to higher blood pressure in Type A persons are discussed.

The Achievement subscale from the Family Climate Inventory was found to be correlated with systolic blood pressure ($r = .62$) for all children examined. The authors, putting together the aspects of the various scales utilized which they felt related to Type A behavior (e.g., Achievement, Intellectual Orientation, and Order and Control), concluded that all of these aspects are correlated with higher blood pressure levels. The blood pressure levels did not differ significantly between children in public school and the Seventh Day Adventist children. It might be noted parenthetically, however, that those children in very religious homes, or in homes with strong support systems, tended to have higher blood pressure. The authors suggest that this may be due to the fact that those controls which adults refer to as supportive, or the controls found in strictly religious homes, are perceived as controlling or restrictive by the children, resulting in the observed higher blood pressure levels.

Manuck, Craft, and Gold (1978) attempted to identify the relationship between Type A and B behavior and systolic pressure under a highly stressful task condition. Fifty-two college students, half male and half female, were

administered a modified version of the Visual-Verbal Test in which the subject must examine sets of four pictures and identify two dimensions common to three of the four pictures. Time allowed, usually up to three minutes, was reduced to six seconds each to make the tasks highly stressful. In addition, eight of the twenty-four test items presented had been found to be unsolvable in less than ten seconds in pilot testing. Type A/B patterns were measured using the JAS Student Form. Systolic pressure was monitored electronically every 40 seconds.

Type A males showed a significantly greater increase in systolic pressure than Type B males (135 vs 126 mmHg, respectively). No differences were found between Type A and Type B females. A second study, using only male subjects, replicated the results indicating greater reactivity in Type A than Type B subjects, and also indicated a similar increase in diastolic pressure.

It is possible that the failure of study 1 to attain similar Type A/B effects for women as found for men is a function of the same factor(s) resulting in the negative findings on heart rate data in women by MacDougall et al. (1981, discussed above), which indicated that female Type A's do not necessarily react to the same types of stressors as do male Type A's.

Dembroski et al. (1979), discussed earlier in the heart rate section, also monitored systolic pressure. It will be recalled that subjects were exposed to a cold pressor (CP)

and reaction time (RT) task under either a high stress or low stress condition. It was found that the Type A subjects under high stress (High-A's) showed the largest change in systolic pressure in both the CP ($\bar{X}$ = 22.8) and RT ($\bar{X}$ = 13.7) tasks. Unlike the heart rate data, however, the low stress Type A subjects showed the next highest change in systolic pressure in both tasks ($\bar{X}$ = 18.1 and 9.5, CP and RT, respectively).

As might have been expected, the low stress Type B's and high stress Type B's showed the least increase in systolic pressure although the CP task resulted in larger changes in blood pressure values than the RT task in all conditions. Therefore, there seems to be a level of challenge effect for systolic pressure as well as heart rate. Although some differences do exist, the Type A persons in the high challenge conditions seemed to be the most affected.

Another study examining the relative effect of high versus low levels of stress, and the relative effects of different types of threats on blood pressure, was conducted by Pittner and Houston (1980). Male college students were classified as Type A or Type B based on scores on the JAS. These 84 subjects were assigned to one of three conditions: threat of shock, threat-to-self-esteem, or a low stress control group. Subjects in the threat-to-self-esteem condition exhibited increased levels of systolic pressure, with Type A's showing a significantly greater increase than

Type B's. Similarly, Type A's in the threat-to-self-esteem condition exhibited greater diastolic pressure increases than Type B subjects. Surprisingly, no significant Type A/B differences were found for systolic or diastolic pressure in the threat of shock condition.

Jennings and Choi (1981), in a study of business executives, found no difference between Type A and Type B baseline blood pressure levels (134/76 versus 134/77). During RT trials, however, systolic pressure was observed to increase in Type A, but not Type B, subjects. No such difference between Type A and Type B subjects was found in the diastolic pressure. These results, then, are very similar to the results in other studies in this section.

In conclusion, the evidence of blood pressure reactivity seems to closely parallel the evidence of heart rate reactivity. Type A subjects appear to react more strongly to stressors, and may react more quickly as well. Level of stressor, as with heart rate, seems to be a major factor in the magnitude of blood pressure reaction. As might be expected, systolic pressure, which is normally more reactive than diastolic pressure, seems to react more readily and markedly than diastolic.

Serum Lipids and Cholesterol

While heart and systolic and diastolic blood pressure are easily measured correlates of coronary prone behavior, they are not as strongly implicated as a causative factor of

CHD, and particularly atherosclerosis, as high serum lipid levels. Simply put, serum lipids are those fats and fatlike substances in the blood, e.g., fats, free fatty acids, cholesterol, and phospholipids (Friedman & Rosenman, 1975). Cholesterol is identified by these authors as the "prime suspect" in coronary artery disease (CAD). Cholesterol is also probably the correlate of heart disease best known to the public in general.

The exact mechanisms for increased levels of cholesterol in the bloodstream are not clear. While non-body produced cholesterol is known to enter the system through the digestive tract (from what we eat), body produced cholesterol levels seem to be controlled by thyroid hormone, pituitary growth hormone, and glucagon (produced by the pancreas) levels acting on the liver and intestines. Therefore, it might be suspected that those stimuli influencing these hormone levels (i.e., causing sympathetic or parasympathetic nervous system stimulation) will in turn result in increased serum cholesterol levels. Following from this, if Type A persons are hyper-responsive to environmental challenge, one might expect to find higher serum cholesterol levels in those persons.

The measurement of serum lipids is considerably more complex than the measurement of blood pressure or heart rate. The drawing of blood is required, as well as laboratory equipment for analysis of the blood (e.g., a centrifuge). With these special requirements for equipment

and procedures come the requirement for personnel trained to administer and operate them. As a result, far fewer studies have examined serum lipid levels than blood pressure or heart rate, with most of those being conducted by, or in collaboration with, physicians, using less representative samples. The evidence from this body of literature is, however, quite compelling.

It is posited by Kannel, Castelli, and Gordon (1979) that the high density lipoprotein (HDL) fraction of cholesterol is "protective," while the low density lipoprotein (LDL) fraction is "atherogenic" (p. 85). These fractions refer to the amount of HDL or LDL to total cholesterol (TC). The higher the "density," the greater the proportion of the lipoprotein is protein rather than cholesterol. Fractions of HDL to LDL (HDL/LDL) also are often presented. Drawing primarily from the Framingham Study data, but adding supplementary evidence, these authors discuss the general medical finding that coronary patients exhibit low levels of HDL. Further research indicates that animals with high HDL/TC fractions are unlikely to develop atherosclerosis. While they agree that CHD or atherosclerosis has a "multifactorial origin," they emphasize the need for the HDL measure to be used as one of those factors.

In a study by Williams, Robinson, and Bailey (1979), the cholesterol (HDL) and triglyceride levels of healthy men were monitored. The HDL/TC fraction was found to be

markedly correlated with suspected risk factors in those subjects, e.g., overall cholesterol level, smoking, lack of exercise, and elevated diastolic blood pressure. Since these factors are considered factors related to CHD and/or atherosclerosis, this relationship with the HDL/TC fraction may serve to provide yet another risk factor. Interestingly, HDL/TC was inversely related to cigarette smoking and weight, while a direct relationship was found between this factor and exercise and alcohol consumption.

The relationship between anxiety, hostility, and cholesterol levels (HDL and LDL) has been provided by Francis (1979). In this study, twenty physical therapy students (seven males and thirteen females) aged 18-30 years, who showed no indication of poor health, were studied over a two and a half month period. The State-Trait Anxiety Inventory and the Multiple Affect Adjective Checklist were administered to score subjects along anxiety and hostility dimensions. Measures taken from the first day back at school after Christmas break were used as control or base levels. Subsequently, the psychological assessments and the blood serum lipid test were given twice a week, every other week, for a total of 12 sessions. Subjects were asked to fast for the 12-14 hour period immediately prior to their scheduled lab sessions, thereby controlling dietary induced cholesterol fluctuations.

Three peaks of stress clearly emerged from the data. Not surprisingly, the beginning of the term, midterm, and

final exam periods were the most stressful. Anxiety, as measured by the two psychological measures, peaked just prior to each exam period,and depression levels peaked on exam days (presumably after the exams). Overall cholesterol levels remained high for the entire term, but two significant peaks occurred, both times 10-12 days after the peak in stress levels (beginning of term and midterm--no measures were made after the finals). The LDL levels followed this same pattern almost identically, while HDL levels never varied significantly. Although serum triglycerides fluctuated greatly during the period of this study, the variations never achieved significance, and did not follow any discernible pattern. The authors discuss their results in the context of numerous other studies which have found almost identical relationships between cholesterol and stress. (It should be noted here that while no fluctuations were found in HDL or triglycerides in relation to periods of stress, subjects in this study were not typed as either A's or B's, which might have resulted in the finding of a relationship between these factors for a given subpopulation (e.g., Type A's).)

McCranie, Simpson, and Stevens (1981), in the process of a year-long study of 112 first year medical students, examined changes in lipid levels, and the relationship between serum lipids and field dependence/field independence. A general measure of cognitive style, the Group Embedded Figures Test, was used to classify subjects

along this dimension. Subjects were administered the JAS for classification as Type A or Type B. Six months later, 82 of the subjects, after a 14 hour fasting period, had blood drawn for lipid and triglyceride screening.

An age effect was found for total cholesterol level, LDL, and the ratio of HDL to TC, with older males having higher total cholesterol and LDL levels, and lower ratio levels. Among both males and females, field dependent Type A's had higher total cholesterol levels than field independent Type A's. In Type B subjects, both male and female, the reverse occurred with the field dependent group having lower levels than the field independent group. In total, then, the order of the four groups, from high to low cholesterol levels, was field dependent Type A > field independent Type B > field independent Type A > field dependent Type B ($\bar{X}$ = 187.4, 174.5, 170.0, and 166.0 mg/dl, respectively). This pattern held for females as well, although the levels were lower for each group except the field dependent Type A group, which exceeded the male subjects' level.

Triglyceride levels (triglycerides are hydrolyzed into free fatty acids by the body) were significantly lower in females than males. Although the difference was not significant, field independent Type A's also tended to have higher triglyceride levels. The failure of this effect to reach significance may well be the result of the small sample of women available in this study (N = 17).

The HDL levels were found to be higher in females, field dependent males and females, and particularly for Type B females. Since, as discussed above, HDL levels seem to be uncorrelated or negatively correlated with increased risk levels for CHD, this increase does not seem to pose a threat of CHD, and may support the hypothesis of the authors that females would exhibit lower levels of serum lipids than males. Such a high level of HDL might actually lower the risk of CHD for those subjects.

Differences in lipid levels in Type A's and B's under stress have been reported in numerous studies. Pincomb, Lovallo, Edwards, Wilson, Tompkins, and Brackett (1982) found that Type A subjects (medical students) reported significantly higher stress levels at exam time than did Type B's, had lower HDL/LDL fractions, especially during exam periods, and had higher cholesterol in general. The authors conclude that the risk of CHD is higher in Type A's, and this risk is further increased by environmental stress.

There is considerable evidence, then, that a) higher serum lipid levels, particularly with low HDL/LDL or HDL/TC ratios, are associated with higher risk of coronary disease, and b) Type A subjects tend to have significantly higher lipid levels than Type B's.

In summary, all three physiological measures--heart rate, blood pressure, and serum lipid levels--reveal differences between Type A and Type B people, especially under stressful conditions. Nearly all of this research was conducted with adults.

RESEARCH WITH CHILDREN

Type A Studies with Children

Matthews (1978) offers the first (and only) literature review on Type A behavior in children. Three major points emerge from this review. First, relatively little work has been conducted to determine the etiology of Type A behavior in children, and a large proportion of this work has been produced by Matthews herself. Second, almost no physiological evidence has been compiled with children. This is probably explained by the ethical considerations one must deal with, such as parental and/or informed consent for research which may inflict some pain (albeit minor) on the subject. Third, Matthews comments that as of that time, differences in "children's sense of time urgency have not been investigated" (p. 214). Research since that time has added little to our knowledge in this latter area. The work on time urgency/estimation has been almost exclusively adult data. The time factor will be discussed in greater detail later, but first a review of the available literature on Type A behavior in children is necessary. If we are to continue to assume that Type A behavior in children is qualitatively the same as Type A behavior in adults, evidence of differences in areas such as achievement

motivation and aggression/competitiveness, commonly noted in Type A adults, must be documented as existing in children.

Exactly when Type A behavior develops remains somewhat unclear. The logical starting point in the study of the etiology of a behavior is to first determine whether or not a genetic component exists. Rahe, Hervig, and Rosenman (1978) compared the occurrence of Type A and Type B behavior in 93 sets of monozygotic and 97 sets of dizygotic male twins living in California. Subjects were between 42 and 56 years of age, with an average age of 48 years. Subjects were classified as A_1, A_2, X, B_3, or B_4, reflecting a continuum of Type A-Type B behavior. Identical twins received identical ratings in 33% of the cases, while fraternal twins were placed in the same categories in 31% of the cases. The authors report that chance agreement would have been 20%. Both groups of twins were significantly more alike than would have been expected by chance, but the two groups did not differ significantly from one another. When classifications were modified to include either the exact or next closest category (e.g., A_1 and/or A_2), identical twins were found to match in 79% of the cases, while fraternal twins matched in 69% of the cases. Chance agreement in this case would have been 52%. Again, both groups of twins differed significantly from chance, but the differences between groups did not reach significance. The authors conclude that the similarities in twins' ratings, whether identical or fraternal, are a result of environmental

influences. Thus, there is no evidence to suggest a genetic component to the Type A/B behavior patterns. The authors do conclude, however, that a dimension they label "heightened psychomotor activity" is a heritable factor. This characteristic was condensed from heritability factors in the California Psychological Inventory, Gough 300 Adjective Check List, and Thurstone Temperament Schedule. Such a characteristic may be instrumental in later development of the Type A behavior patterns.

Several measures of Type A behavior have been developed for use with children and adolescents. The preferred form of assessment is the interview, in which the interviewer is able to observe behavior patterns during the interview. Such behaviors as sighing, foot or finger tapping, and explosive speech characteristics are often more informative than self-report measures, provided the subjects are old enough to deal with the interview situation. Dembroski, Caffrey, Jenkins, Rosenman, Spielberger, and Tasto (1978) review literature which suggest that, at least for adults, the interview technique provides a more accurate predictor of subsequent coronary disease than do self-report surveys.

The question of which type of assessment to use with young children is less problematic, however. Matthews and Angulo (1980) point out that the use of interview techniques with elementary school children places too great a demand upon the child's verbal ability and emotional maturity. Such children probably are not capable of making accurate

self-assessments, rendering even a self-report survey highly suspect. Because of these problems, Matthews and Angulo have developed and standardized the Matthews Youth Test for Health (MYTH), a Likert scale questionnaire which the child's teacher completes, identifying various behavior patterns as relatively characteristic or uncharacteristic of that child. For example, "This child interrupts others," or "This child gets irritated easily."

In the process of standardizing the MYTH, Matthews found two factor loadings which she has labeled competitiveness and impatience-aggression. These factors are strikingly similar to loadings found on two adult assessments, the Jenkins Activity Survey, with factors labeled hard-driving/conscientious, job involvement, and speed/impatience (Jenkins, 1980), and the Structured Interview, with factors of pressured drive and competitiveness (Matthews, 1982). Subsequent research by Matthews and others has served to further identify the behavioral components of Type A behavior in children.

Identification of children as Type A or Type B has been completed with children as young as 3-5 years old using the MYTH for classification purposes. Corrigan and Moskowitz (in press) found a test-retest reliability of r = .99 between Fall and Spring semesters when the MYTH was completed by the school head teacher. As has been found in older children (Matthews & Angulo, 1980), boys scored significantly higher on the MYTH than girls. The behavior pattern, then, seems to be firmly established even in the preschool population.

Because these patterns emerge before the children enter school, and because a genetic component is largely ruled out, research examining parent-child interactions has been conducted. Matthews, Glass, and Richins (1977) examined mother-son interaction patterns while they were engaged in various tasks. Mothers provided less positive reinforcement to their Type A children while being more likely to demand greater effort from them. In order to determine whether this pattern was simply a result of parental "reading" of their own child's behavior type, Matthews (1977) had 40 mothers of elementary school children interact with Type A or B children unrelated to them. The mothers were classified as Type A or B using the Jenkins Activity Survey (JAS), a self-report questionnaire commonly utilized for this purpose. The children, aged 8-10, were extreme Type A or Type B, as measured by the MYTH. The children were trained to display characteristic Type A or Type B behavior. Then the children (confederates) worked with the mothers on two tasks.

In partial contradiction with the Matthews et al. (1977) study, results indicated that Type A children received more positive feedback and "pushes" (e.g., "try again") from the women than did Type B children. Type A mothers gave approximately the same amount of positive feedback and pushes to both Type A and Type B children, while Type B mothers gave more positive feedback and pushes to Type A children. Matthews concludes that there were

child effects only on the Type B mothers. She further suggests that mothers may be more tolerant of typical Type A behavior in other children than in her own.

There is evidence, then, that Type A behavior is learned early in life. Further, patterns of interactions between Type A and B children and others are affected by the children's behavior patterns. These interactions are also influenced by the behavior pattern of the caregiver or others in the child's social milieu, presenting a complicated circular pattern of modeling, behavior, and reinforcement.

Competitiveness, impatience, and aggression in Type A and Type B elementary school children were examined by Matthews and Angulo (1980). Second and sixth grade boys and girls were classified as Type A or B using the MYTH. Impatience was measured by requiring the children to trace a star at normal speed, at a faster speed, at a slower speed, very slowly, and while viewing their work in a mirror. Competitiveness was evaluated by having the children race a toy car against the experimenter, who raced at a constant speed. Aggressive behavior was observed when the children were put in a room with numerous toys, books, and a Bobo doll. The experimenter's invitations to aggress were subtle at first, but gradually became more explicit. Finally, the experimenter suggested that the child hit the Bobo doll if the child had not done so spontaneously. Results indicated that there were no Type A/B differences on

the star tracing task, but Type A children won the car race by a larger margin than Type B children, and Type A children aggressed against the Bobo doll more than Type B children. In all tasks, more sighing, tongue clicking, and restlessness were observed in Type A children, indicating greater impatience. The data, then, support the hypothesis that Type A children are more impatient, competitive, and aggressive.

Other investigators, using different assessment techniques, have also provided data supporting differences in the behaviors of Type A and Type B children. Wolf, Sklov, Wenzl, Hunter, and Berenson (1982) utilized a self-report measure of Type A/B behavior developed by Wolf and his associates (Wolf, Hunter, & Weber, 1979) to classify fifth and sixth grade children as Type A or B. Children were instructed to read an emotional passage aloud, eat two graham crackers, deliver a note to a drop box 75 feet from the test room, compete against the experimenter in a marble dropping game, estimate the passage of one minute while sorting marbles, and cross out each numeral 3 they found in a 16 x 36 matrix of numbers.

Wolf et al. (1982) report that, consistent with data on Type A adults, Type A children spoke more loudly than Type B children during the reading task, and ate faster than Type B children. Type A males, but not females, walked faster than Type B males. In the competition task (dropping marbles), the Type A children dropped more marbles than Type B

children. In the time estimation task, an ANOVA was performed on actual time elapsed using the number of marbles sorted as the covariate. Type A children judged that one minute had passed earlier than did Type B children. This last finding is of major relevance to the present study, and is discussed further later. Finally, supporting the expectation that Type A children would work more quickly than Type B children, Type A children crossed out more digits in the allotted time than their Type B counterparts.

A common characteristic of the Type A adult is a drive to excel at any task in which he or she is involved. Questions tapping this tendency are common in most scales of Type A behavior, e.g., "When you play games with people your age, do you play for the fun of it, or are you really in there to win?" (Structured Interview), or "Would people who know you well agree that you enjoy 'a contest' (competition) and try hard to win?" (Jenkins Activity Survey, Student Form).

Similar characteristics have been noted in elementary school children as well. Matthews and Volkin (1981) required 34 fourth graders to perform math problems either with or without an explicit five minute deadline. As in adults, Type A children outperformed Type B children when no mention of a deadline was made. When a deadline was made explicit, however, Type B children improved their performance to approach, but not equal, the Type A subjects' level. Perhaps more revealing was the lack of improvement

by Type A children between the no deadline and deadline conditions, in which the subjects averaged 53.6 and 52.6 problems attempted, respectively. The performance of Type B children improved under the deadline condition, increasing from 38.2 to 44.6 problems attempted. Type A children seem to perform at their highest level of effort at all times, while Type B children vary their degree of effort according to the explicit demands of the task.

In a second experiment, Matthews and Volkin (1981) had children squeeze a hand dynamometer to determine individual baselines of strength. Subjects then were asked to hold a container with lead weights, the weight varying according to the dynamometer reading, while answering questions regarding their subjective feeling of fatigue. By using the hand dynamometer to establish a baseline strength reading, followed by a set proportional increase in weight to be held, the authors made the task equally physically demanding for all subjects. Type A children held the weights 50% longer than Type B children, apparently in an attempt to excel over their peers. Despite the longer period of holding the weight, Type A children reported lower subjective levels of fatigue. Both experiments seem to indicate that, like their adult counterparts, Type A children are more achievement motivated, or attempt to excel at most tasks.

Several explanations for the development of the general Type A behavior pattern in children have been proposed.

However, two of those explanations have become increasingly popular.

First, the tendency for Type A children to excel and be more achievement oriented may reflect their desire to exercise as much control as possible over their environment. If this is true, then the threat of loss of control of a situation should elicit stronger reactions from Type A than Type B children. As Matthews (1982) comments, this approach views the Type A behavior pattern as a coping mechanism.

Matthews (1979) tested this hypothesis by examining 90 male fourth and fifth graders and 69 male undergraduates. Subjects were seated before a cabinet with a spring loaded button and a red "reward" light at eye level, and were told that they would be earning nickels by pushing the button. However, the subjects had to learn how many times they had to push the button to receive the reward, i.e., what the reinforcement schedule was. The nickels were presented either on a FR7 or a VR7 schedule, the VR7 schedule being the less controllable condition. In addition, the experiment took place under one of two salience conditions. In the low salience condition, the room was well lighted and the red "reward" light was in view, but disconnected. In the high salience condition, the room was darkened with a high intensity lamp on the apparatus. Reinforcement (nickels) were received in both conditions. The red "reward" light came on upon the delivery of each nickel. It was expected that of the four conditions, Type A subjects

would respond most rapidly under the high salience condition of the VR7 reinforcement schedule, since this would increase their perception of lack of control. The results supported the hypothesis. Type A subjects performed faster than Type B subjects in the high salience VR7 condition. No other differences were noted. Both adults and children responded in this way, although adults were faster overall than children. In self reports of degree of perceived control, Type B children seemed unaffected by the varying schedules, whereas Type A children and all adults perceived greater control in the FR7 condition. The data seem to support the possibility that perceived control is a major factor in Type A behavior in both children and adults.

A second major approach to the development of Type A behavior in children has been suggested by Matthews and Siegel (1983). These authors suggest that Type A children may be those who value achievement but lack the appropriate training or skills to evaluate their performance. In the absence of explicit evaluation criteria, children may tend to compare their performance with an inappropriately superior person. For example, without appropriate criteria for evaluating one's tennis prowess, one may seek out another individual to compare performance with, perhaps someone such as John McEnroe. Most of us would then be hard pressed to match the skill level of a McEnroe.

To test this tendency for social comparison, fourth grade children were asked to list as many uses as possible

for five items. Each item was presented individually with a one minute break between trials. During breaks the child could relax, read, or examine folders describing other children's performances. Children were either told that three uses per item was "pretty good" before each trial, or were not given any evaluative criteria. After the last trial, the child was told that he/she had scored right in the middle of all of the children tested. Children were then told that they could compare their final performance with one other child's by looking at that child's folder.

Results indicated that girls tended to examine the same number of folders, whether in the standard or no-standard condition, while boys in the no-standard condition examined more folders than boys in the standard condition. It was also found that children in the no-standard condition were more likely to examine the top scorer's folder at the end of the study. Further analysis showed that Type B children followed this latter pattern, while Type A children chose to examine the top scorer's folder <u>regardless</u> of the condition. Type A children appear to have higher goals or expectations than Type B children, and choose to compare their work to the best or fastest individual available. Ambiguous standards led all children to compare themselves with superior performers, but Type A children chose to make that comparison even when they had been assured that their performance was "pretty good." The results, then, indicate that the existence of high standards of performance and

ambiguous criteria may promote Type A behaviors. Such conditions may be related to the patterns of mother-child interaction noted by Matthews.

Matthews (1982) cautions researchers from seeking a single cause-effect model. She suggests that a combination of causes, such as both ambiguous standards and uncontrollability, will more likely provide an explanation of the Type A behavior pattern in children.

The Time Factor in Coronary Prone Behavior

Every description of Type A behavior, whether for adults, adolescents, or children, includes a time related characteristic. This may be seen in factor loadings labeled as impatience (Structure Interview), speed-impatience (Jenkins Activity Survey), or impatience-aggression (MYTH). Despite the omnipresence of this factor, however, relatively little research has examined this component.

Most of the research in this area has examined "time urgency." Glass, Snyder, and Hollis (1974) tested male undergraduates using a DRL 20 paradigm in which subjects had to press a button after 20, but before 25 seconds, after their last response. If accurate, a green light was illuminated for three seconds; if incorrect, a red light was illuminated for the same period. A small monetary reward was offered for each successful response. This task requires the subject to estimate the passage of time fairly accurately, and to withhold response until the required time

(20 seconds) has passed. Type A subjects received a significantly lower percentage of reinforcements than did Type B subjects, primarily because they responded between 10 and 20 seconds after their last response. These results are explained by the authors as a function of time urgency. However, the failure of the Type A subjects to wait the required 20 seconds may be a result of an inability to consistently estimate the passage of time accurately. That most of the incorrect responses by Type A subjects were in the 10-20 second period suggests that they may be more likely to over-estimate the passage of time.

Gastorf (1980) recorded the arrival time of subjects for an experiment. The subjects (120 male and 120 female college students) had previously been administered the JAS Student Form. Both male and female Type A subjects arrived significantly earlier than Type B subjects, averaging 4.95 and 1.10 minutes early, respectively. Gastorf relates this tendency to the general sense of time urgency noted in Type A people.

Yarnold and Grimm (1982) required 22 female undergraduates to read a technical paper until they believed that one minute had passed. Significant differences were found between subjects classified as Type A or Type B in their ability to estimate time, averaging 61.4 and 77.2 seconds, respectively. These authors also discuss their results in terms of time urgency, although no difference in reading rate was noted. It is again suggested that time or

duration estimation abilities, rather than time urgency, may provide a more plausible explanation.

Other studies have reported similar results. Burnam, Pennebaker, and Glass (1975) asked 62 undergraduates to read a passage until they believed one minute had passed. Actual time allowed to pass differed between Type A and Type B subjects, with Type A subjects averaging 52.6 seconds and Type B subjects averaging 75.0 seconds. These data suggest that both Type A and Type B subjects may be inaccurate time estimators, but in different directions.

Finally, in a study discussed earlier, Wolf et al. (1982) asked fifth and sixth grade children to estimate the passage of one minute while sorting marbles into two cans. The authors report that black children estimated the passage of one minute more quickly than white children (52.8 and 61.6 seconds, respectively), and when race was controlled, Type A children estimated the passage of one minute earlier than Type B children (55.3 and 59.2 seconds, respectively). This is the only study located which discussed the results in terms of time estimation abilities in Type A and B children.

It is suggested by the present author that much of the observed "time urgency" in Type A individuals, both adults and children, is in fact a result of inaccurate estimation of the passage of time. Even though there has been little research on this ability, the research which exists consistently supports the possibility of a difference in time estimation abilities between Type A and Type B people.

Such an inability could have a marked influence on an individual's general personality or behavior type. A hypothetical example may help to illustrate this point.

John is an eight year old boy in second grade. He has been raised by parents who stress the Protestant work ethic, demanding high achievement levels. When assigned work, John works to do his best. However, John also is somewhat inaccurate in estimating the passage of time, usually overestimating the time duration. Because of this, John, who is trying to maintain a high level of achievement, commonly feels rushed since he perceives time as passing more quickly than it really is. As a result of this tendency, John has learned to work faster to meet the deadlines of his internal clock. Interruptions of his work will only serve to irritate him since they delay further this work. In short, overestimation of time passage may be part of a vicious cycle which may explain some of the Type A behaviors.

Compare John with Tom, who tends to underestimate the passage of time. Tom feels none of the pressure John feels since he is not under any time constraints. Waiting in line for him may not seem to take as long as it does to John. Interruptions of his work will rarely irritate him since he feels little or no time pressure. Tom would probably be more likely to exhibit behaviors common in Type B persons.

The tendency to chronically overestimate the passage of time may be a result of the information processing loads of

the tasks in which individuals are involved. Ornstein (1969) has suggested that the perception of the passage of time is a result of the amount and complexity of information processed over a period of time. The greater the amount of information processed, the greater the perceived length of time. Ornstein presents empirical evidence to support his hypothesis, both for the amount and complexity of information processed.

Although Ornstein's hypothesis has been discussed briefly in several articles dealing with time urgency in Type A children or adults, there has been no attempt to relate this approach to time perception to the development of Type A behavior. The present study is the first to systematically investigate this possibility.

One of the major characteristics of the Type A individual is the tendency to work faster than Type B individuals. If Ornstein's theory is correct, the Type A individual, by working more quickly, processes more information than a Type B over a given period of time, and therefore would be more likely to overestimate the passage of time. Whether it is the time estimation problem or the tendency to work quickly which begins first is another chicken and the egg dilemma. If the individual begins to work more quickly, then the information processing load will be greater than the Type B's, resulting in the perception that time is passing more quickly than it really is. With this perception, the Type A individual, sensing that he or

she is losing control of the situation, may react by working faster, which then compounds the problem by increasing the rate at which information is processed. Thus the Type A individual may be unwittingly drawn into a vicious cycle, with inaccurate time estimation leading to a faster work rate leading to continued inaccurate time estimation.

Expected Results

No research has examined the relationship between the Type A/B behavior pattern and time estimation abilities in children under 5th grade. Therefore, third graders are examined in this study to extend our knowledge of this relationship to a younger age group. Fifth graders are examined to replicate the results of Wolf et al. (1982) and to examine what types of task demands might influence time estimation.

Subjects will be administered a time estimation scale (the STES) in order to examine the amount of time they estimate is required to complete various tasks or events. Children then will be asked to estimate the passage of one minute while performing various reading and math tasks, or while sitting quietly. The STES scores and the amount of actual time which elapses while the children estimate one minute will be examined for Type A/B differences.

Based upon the preceding review, it is expected that males in both third and fifth grade will obtain higher scores on the MYTH than females, i.e., males will tend to be

more Type A. Mean scores on the MYTH are not expected to vary between the two grades, replicating the findings of Matthew and Angulo (1980).

It is further expected that Type A individuals will be more likely to overestimate the passage of one minute under various behavioral or task conditions. If third and fifth grade children perform in a fashion parallel to their older counterparts, Type A children should estimate that one minute has passed prior to the actual passing of one minute, while Type B children should either be relatively accurate, or underestimate the passage of time, i.e., report the passage of one minute when more than one minute has actually elapsed. This tendency is expected to occur in all time estimation conditions.

Type A children are expected to perform at their best or fastest pace regardless of the type of stress condition. Therefore, Type A children should attempt a greater number of math problems per unit of time than Type B children when there is no stress on their performance. When performance is stressed, however, Type B children should increase their rate of work to approximate the Type A level, which should remain at its peak level.

On the STES, results can logically be expected in either of two directions: a) Type A children, as a result of their tendency to work and play at a faster rate than Type B children, will estimate that the activities described in the STES take less time than will the Type B children. This

possibility assumes that the children's time estimation abilities will be accurate on this scale; or b) Type A children will tend to overestimate the amount of time required to complete the various tasks listed in the STES, resulting in higher scores on the scale than Type B children. This possibility would explain why Type A children work more quickly than Type B children. If they expect that a task will take longer than it really will, and are very competitive, they would be expected to work more quickly in order to complete that task as soon as possible. Since neither this scale nor any other time estimation scale of its sort have been administered to determine the relationship between time estimation abilities and Type A/B behavior, this study will serve to test these possibilities.

In order to test Ornstein's theory of time estimation, there will be a comparison of time estimation in fast paced and slow paced conditions, in which the amount of information to be processed per unit of time will be controlled by the experimenter. Ornstein's theory would predict that all children, regardless of their classification as Type A or Type B, will perceive time as passing more quickly under the fast paced conditions than the slow paced conditions as a result of a greater amount of information being processed in a shorter period of time in the fast paced condition.

METHODS

Subjects

Forty-one third graders and forty-nine fifth graders were selected from a local elementary school. Approximately equal numbers of males and females were obtained in fifth grade. In the third grade group, however, 24 females and 17 males were obtained. Both age groups were ethnically and economically mixed, but predominantly white and middle class. The third graders' ages ranged from 7-8 to 11-0, with an average of 9-0 years. Fifth graders' ages ranged from 10-0 to 12-1, with an average of 10-11 years.

Parental consent forms explaining the nature of the study and broadly outlining the procedures to be followed were sent home with the children (see Appendix A). Approximately 40% of the forms were returned with parental consent to test the child.

Materials

Matthews Youth Test for Health (MYTH)

Created by Matthews and Angulo (1980), the MYTH was used to classify children along a continuum from extreme Type B to extreme Type A. The scale consists of 17 scored

items, with each item rated on a seven point Likert scale. Each item can be scored from 1 (very uncharacteristic) to 7 (very characteristic). The items are then totalled to give each child a score which may range from 17 to 85 points. The MYTH was completed by the child's teacher, who was advised to rate each child using all third (or fifth) graders as a comparison group (see Appendix B).

Short Time Estimation Scale (STES)

The STES is a paper and pencil time estimation scale developed by the author to compare children's opinions regarding the time required to complete numerous tasks. The scale includes 22 items, presented in three blocks corresponding to three different 30 point time scales: a) seven items on a 0-30 second scale; b) seven items on a 0-6 minute scale; and c) eight items on a 0-60 minute scale (see Appendix C). The use of a 30 point scale made the three subscales comparable. In each grade, most of the children were administered this scale as a group. Children taking this scale respond by drawing a line through the point in the scale which they feel best estimates the time required to complete that task (e.g., "How long does it take you to eat a hamburger?"). After completing the 22 items, each child is asked to estimate how many minutes it took him or her to complete the entire scale.

Behavioral Measures

Measures of children's estimations of time in a series of trials (conditions) were obtained in a session with each child. In the unpaced reading conditions, children were asked to read one-page stories selected from third or fifth grade readers. In order to assure age-appropriateness of the reading materials, the children's teachers were consulted regarding the selection of the stories.

The unpaced math conditions employed an 8 1/2 x 11 page of 39 simple, one-digit multiplication problems. Multiplication problems were selected due to their appropriateness for both third and fifth graders. The same problems were utilized for both grades, with no apparent ceiling effect (see Appendix D).

For the paced mathematics conditions, Kenworthy Educational Service vertical multiplication flash cards (No. 2137) were used, presented in a prearranged random sequence. The cards measure 22 x 7.5 cm with green lettering on white backgrounds. Examples are offered in Appendix E.

The paced reading conditions utilized 31 x 7.5 cm horizontal yellow strips with black printed sentences. The sentences were constructed to be similar in syntax, with a subject, verb, and modifier in each sentence. Appendix F provides examples of these sentences.

Procedure

A copy of the MYTH for each child returning the consent form was provided for that child's teacher. Teachers were asked to compare each child to all third (or fifth) grade children they know. The MYTHs were completed at the teachers' convenience and collected by the principal investigator.

Children were tested in two sessions. First, the STES was administered to the children in each grade as a group. A few children who were absent on the day of the group testing or who returned their consent forms after the test session were administered the STES after all individual testing had been completed. The group sessions lasted approximately 20 minutes.

Second, each child was individually tested for the behavioral measures. The individual session lasted from 15 to 25 minutes depending upon how accurate (or inaccurate) the child was during the session.

In the STES group sessions, children were given a copy of the STES, and any children wearing a watch were asked to put it in their pocket or to give it to one of the two experimenters. All clocks in the room were covered before testing began. The children were then guided through the test, with the primary investigator reading each question aloud and clarifying any of the questions. Each time scale (0-30 sec; 0-6 min; 0-60 min) was described to the subjects to avoid confusion due to changes in the length of the scales. At the conclusion of the test, each child was asked

to indicate how many minutes had elapsed since starting the scale. The children were then asked to indicate on the test whether or not they had been wearing a watch that morning. The children's watches were returned, and the group was thanked for their help.

Individual testing was completed by the principal investigator and a male psychology graduate, both of whom were blind as to the subjects' Type A/Type B classification. Testing was conducted in various locations in the school, depending upon availability of space. All locations were relatively quiet and distraction free. Any clocks in the room were covered and any watches worn by children were removed prior to testing.

Each child was told that he or she would be doing some math problems and reading some sentences, and that he or she would be asked to estimate when one minute had passed under those conditions. To demonstrate and to emphasize the time estimation aspect of the task, the first condition always required the subject to sit quietly and tell the experimenter when one minute had passed ("blank" condition). After this condition, the child was given either the four paced or four unpaced trials (described below) with the order of presentation of these two conditions counterbalanced. Another "blank" trial always occurred on trial 6, between the paced and unpaced trials. The last (eleventh) trial was always another "blank" time estimation trial. These "blank" trials were used to examine changes in

time estimation over the duration of the test session. In all conditions, the clock was started when the experimenter said "start," and was stopped upon the verbal response of the child. A complete list of counterbalancing schedules is presented in Appendix G. Each child was given all of the conditions, but there were four possible orders.

In the paced conditions, the experimenter showed the child a multiplication flash card or sentence card in a "fast" (VI-5 seconds) and a "slow" (VI-10 seconds) condition, with the order of the speeds of presentation counterbalanced. Variable intervals were utilized to prevent the child from using the pace itself to estimate time. Mathematics always preceded the sentence presentation in each condition. To cue the experimenter for the VI-5 or VI-10 conditions, a cassette tape gave verbal commands over an earphone at the appropriate intervals. Before each condition, each child was reminded to tell the experimenter when she or he thought one minute had passed, i.e., say "stop." In order to insure the children's active participation, subjects were required to read the sentences aloud, and to record their answers to the math problems on a scoresheet. Actual time lapse was recorded using digital stopwatches. Following completion of the math and sentence materials in one speed condition, the same procedures were used in the second speed condition.

Two types of unpaced conditions were used, stressed and non-stressed, with order of presentation counterbalanced.

In the non-stressed conditions, the children were given a sheet of math problems. They were told to start solving the problems, to stop when they thought one minute had passed, and to say "Stop" to the experimenter. Each child was then given a story to read, with instructions to read the story aloud until he or she thought one minute had passed.

In the stressed conditions, the children were presented with the same tasks as above (but with different stories to read). This time, however, each child was told to "answer as many as you can (read as fast as possible) without making any mistakes." The children were reminded before each trial to tell the experimenter when they thought one minute had passed. Actual time lapse was recorded for all conditions.

After the last "blank" trial, all children were thanked for their participation and praised for their performance. They were then returned to their classroom.

Scoring

The MYTH was scored by totalling the points for each of the 17 scored items, with numbers 5, 11, and 13 being coded in reverse. The children's scores, then, could range from 17 to 85, with higher scores indicating greater Type A tendencies.

The STES was scored by totalling the number of units of time (0 to 30 on each trial) chosen by the child on each of the three subscales, subscale A and B with 7 items each

and subscale C with 8 items, as well as the total scale. The scores for the first two subscales could therefore have ranged from 7 to 210, and the third subscale from 8 to 240. The total scale range, then, could be from 22 to 660, with higher scores indicating longer times in their estimations.

Behavioral measures were scored by recording the actual time lapse before the child said "stop" in each of the eleven trials. In those cases when subjects exceeded two minutes (actual time), they were stopped and two minutes was the time recorded for that trial. This was an established pattern (four or more trials) for only three third and four fifth graders. Two minutes was selected as a deadline since there were only enough mathematics flash cards and sentence cards for a two minute period.

Data were analyzed using a multiple regression model to test the predictability of MYTH scores by the various variables. This model was adopted instead of the more common ANOVA in order to include the data from all of the subjects without using an arbitrary cutoff for Type A and Type B (e.g., with a median split, commonly used in this area of research). Predictor variables were STES scores (three subscales and full scale), paced and unpaced total scores, and total "blank" trial scores. All data were examined by age and sex. The results within each task were examined by analyses of variance. A median split defined the Type A and Type B groups.

RESULTS

Behavioral Measures

A pair of regression analyses examined the Type A-Type B rating of the children (MYTH scores) as predicted by sex, grade, and either the paced or unpaced behavioral task time measures. Both analyses reflected only a significant sex effect F (1,78) = 4.34, $p < .05$, and a significant grade effect, F (1,78) = 7.50, $p < .01$. As expected, females had significantly lower scores (M = 47.15), i.e., were less Type A, than males (M = 51.09). No age effect was expected. However, third graders were scored significantly higher on the MYTH (M = 51.35) than fifth graders (M = 46.97), a difference of more than four points. Consequently, when subsequent analyses called for classifying subjects as Type A or Type B, median splits within each grade were used.

The absolute amount of difference reflected in these significant effects can best be seen in the context of the overall characteristics of the group. The range of MYTH scores was from 28 to 71, with a standard deviation of 9 points.

The lack of a relationship between the behavioral measures and Type A ratings is contrary to the hypotheses of the study. However, as will be seen in the analyses

of variance reported below, a complex relationship does exist.

Time Estimation

Initial analyses of math versus verbal scores in each of the behavioral conditions (unpaced-no stress, unpaced-stress, paced-slow, and paced-fast) failed to indicate any significant differences. Therefore math and verbal scores were averaged for each condition in subsequent analyses. Time estimation scores in the three "blank" conditions (no math or verbal task) did not differ significantly; therefore they were averaged into a single "blank" score for analyses. These transformations resulted in the reduction of the number of behavioral measures from eleven to five scores. These five scores for each grade are presented in Table 1.

In order to examine the relationships between these variables and the MYTH, and to provide results in a comparable format to earlier research, MYTH scores were divided using a median split for third and fifth graders (52 and 45, respectively). An analysis of variance examining subject type (2: A or B), grade (2), sex (2), and behavioral time estimation trials (5), with repeated measures on the last variable revealed a significant grade effect, F (1,82) = 6.50, $p < .02$. Third grade students estimated the passage of one minute after an average elapsed time of 67.85 seconds across all behavioral conditions, while fifth graders averaged 76.69 seconds. Thus, third

Table 1. Mean Time Estimation Scores (in seconds) in Each Behavioral Condition for Type A and Type B Children by Grade

	"BLANK"	UNPACED-NOSTRESS	UNPACED-STRESS	PACED-SLOW	PACED-FAST
			Fifth Grade		
Type A	51.36	87.04	92.23	76.95	72.37
Type B	52.60	88.09	95.38	81.26	69.50
Total	51.99	87.56	93.80	79.14	70.90
			Third Grade		
Type A	46.97	76.08	82.83	66.45	67.23
Type B	41.98	80.52	76.07	74.76	66.08
Total	44.64	77.90	79.70	70.30	66.68

graders were more accurate. No such effect of age was predicted.

Previous work (Matthews & Angulo, 1980) has identified two factors on the MYTH--impatience/aggression and competitiveness. Because time estimation skills should be most closely related to impatience, the impatience/aggression factor was the subject of the next analysis.

An ANOVA examined the same variables as in the above ANOVA, but classified subjects as Type A or Type B on the basis of a median split on scores on the impatience/aggression factor. It was expected that although the overall subject type as determined on the basis of the entire MYTH score was not related to time estimation abilities, the time related factor on the MYTH would be related to performance on the behavioral task time estimation performance. A significant trial x sex x type interaction was obtained, F (4,328) = 2.65, $p < .05$. Figure 1 illustrates this interaction.

In order to examine this interaction further, a series of pairwise comparisons was made using Bonferroni adjustments to compensate for the number of tests. The comparisons revealed that the amount of time which actually elapsed while subjects estimated the passage of one minute was greater in the unpaced-stress condition than the unpaced-no stress condition, but only for Type A males, t (26) = 2.50, $p < .02$. Mean time estimations in these stress and no stress conditions were 92.0 and 85.4 seconds, respectively. No such difference in time estimation had

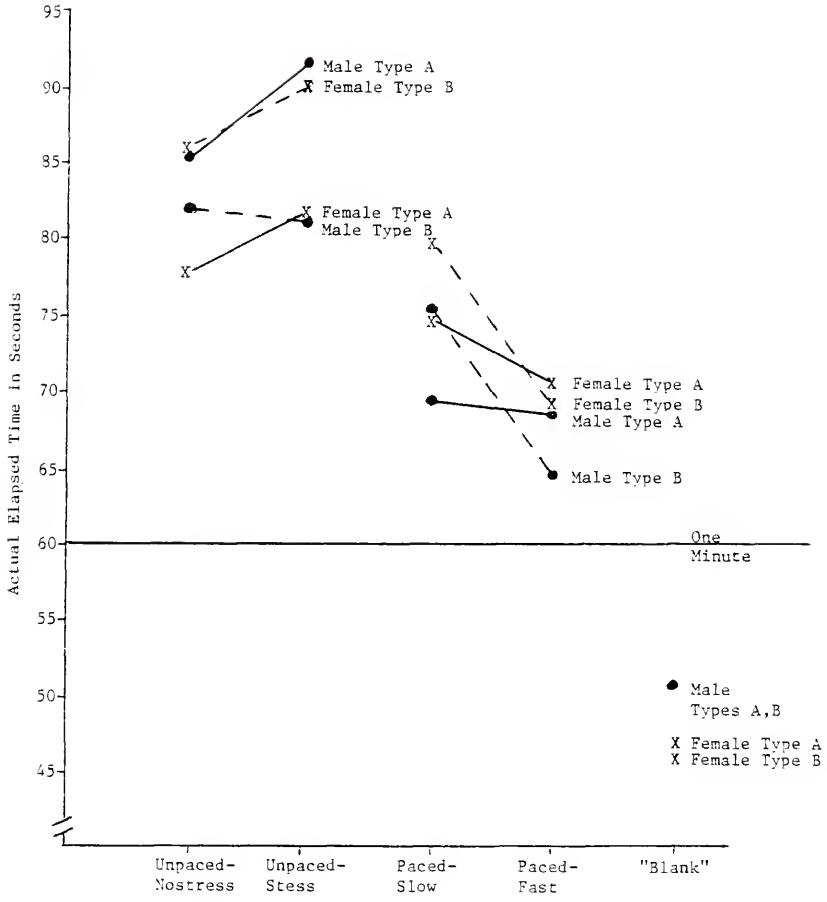


Figure 1. Sex and Type Effects on Time Estimation During Behavioral Tasks

been expected. No other group (Type A females, Type B males or females) demonstrated a significant difference in their time estimation between these conditions.

Comparisons of time estimation under the paced-slow and paced-fast conditions indicated that while neither Type A males' nor females' time estimation differed between these trials, Type B males' and females' time estimation was significantly larger in the paced-slow than the paced-fast condition, t (15) = 3.47, $p < .01$, and t (27) = 2.96, $p < .01$, for males and females, respectively (see Figure 1). This comparison provides a test of Ornstein's theory of time estimation. His theory would predict that subjects' time estimation would be longer in the paced-slow than the paced-fast conditions because a longer period of time would be required to process the same amount of information in the former condition. This hypothesis was supported for Type B subjects only. Type B males' time estimation averages dropped from 75.84 to 64.43 seconds, while Type B females dropped from 79.96 to 69.5 seconds. Type A subjects' mean estimation times did not differ significantly, and in neither group declined even as much as four seconds. Thus Ornstein's theory does not seem to apply to all individuals under all behavioral conditions.

One further finding of interest, illustrated in Figure 1, should be noted. All subject groups, regardless of sex or A/B type, tended to overestimate time (i.e., perceive time as passing more quickly than it really was) in the

"blank" conditions, with male Type A and Type B subjects averaging 51.03 and 51.08 seconds, respectively, and female Type A and Type B subjects averaging 46.71 and 46.26 seconds, respectively. However, when engaged in any of the behavioral tasks (reading or solving math problems), all subject groups tended to underestimate the passage of time (i.e., perceived time as passing less quickly than it really was). The condition with the lowest mean time estimation score other than the "blank" trials was the paced-fast condition, where the lowest time estimation average was for male Type B subjects, who averaged 65.43 seconds. All groups in all of the behavioral task conditions differed significantly from the "blank" conditions, the lowest t (for the male Type B subjects) = 4.04, $p < .001$. It therefore seems that if otherwise occupied, elementary school children's time estimation will vary significantly from when they are asked to simply estimate the passage of one minute when unoccupied.

Number of Problems Attempted in the Unpaced-Stress and Unpaced-Nostress Conditions

In the two unpaced conditions, subjects controlled how many math problems they attempted. It was hypothesized that Type A subjects would perform at their peak rate of speed on the math tasks regardless of whether they were performing under a stressed or unstressed condition. It was further expected that Type B subjects would attempt to complete

fewer problems, i.e., work more slowly, than Type A subjects under the no stress condition, but would approximately match the Type A performance level when performing in the stress condition. To test these hypotheses, an ANOVA examined subject type (2), grade (2), sex (2), and trial condition (2), with repeated measures on the last factor. The number of problems attempted under each condition was the dependent measure. A significant grade effect, F (1,82) = 27.05, $p < .0001$, was found. This result was to be expected, and merely reflects the fifth graders' superior mathematics ability compared to third graders. No other effects were noted.

As before, the data were re-examined using performance on the impatience/aggression factor of the MYTH to classify subjects as Type A or Type B. This analysis revealed a significant trial x grade x type interaction, F (1,82) = 6.66, $p < .02$. Subsequent pairwise comparison t-tests revealed that, as expected, fifth grade Type B subjects attempted more problems in the stress than the no stress condition, t (24) = 3.02, $p < .01$. Under the no stress condition, they attempted an average of 37.9 problems, but under the stress condition they attempted 44.08 problems. As expected, Type A fifth graders did not significantly alter the number of problems attempted.

For third graders, the pattern was reversed. Type A subjects increased the number of problems attempted from the no stress condition (M = 20.95) to the stress condition

($\underline{M}$ = 26.41), $\underline{t}$ (39) = 3.42, $\underline{p} < .01$. No significant difference in the number of problems attempted was noted for Type B third graders. Thus the predicted results were obtained for fifth graders, but not for third graders.

Additional t-tests indicated that Type A and Type B subjects did not differ significantly from each other within each condition in either grade. That is, ability level, as reflected by the number of problems attempted, does not seem to be a factor in the reported effects. While the means for Type A subjects were higher than for Type B subjects, a large amount of variability, with standard deviations ranging from 11 to 14, prevented the difference from reaching significance.

The number of problems attempted and the time spent solving problems during the period the child estimated to be one minute logically should be related. Indeed, correlations between the unpaced-no stress and unpaced-stress time estimation scores and the number of problems attempted were significantly correlated for all children, regardless of grade. For third graders, the correlations ranged from .50 to .75, all significant at the .0001 level. Fifth grade correlations ranged from .30 to .55, all significant at the .02 level.

Because of these significant correlations, the above analyses concerning number of problems attempted must be clarified by looking at the rate of solving problems. To determine whether there were differences in rate of problem

solving between grades or groups, an ANOVA examined sex (2), grade (2), subject type (2), and trial condition (2: unstressed and stressed) with repeated measures on the last variable. Results revealed a significant effect of grade, F (1,82) = 14.81, $p < .001$. Third grade children averaged 3.5 seconds per problem attempted, while fifth grade children averaged 2.31 seconds per problem, a result which would be expected.

A second ANOVA examining the same variables as above, but using impatience/aggression scores for classifying individuals as Type A or Type B, revealed a significant trial condition x grade x type interaction, F (1,82) = 5.16, $p < .05$. Pairwise comparison t-tests, however, revealed that the effect was due to a marginally significant difference in time required per problem between Type A and Type B third graders in the no stress condition, t (39) = 1.91, $p < .065$. The rate of problem solving was faster for all groups in fifth grade than in their third grade counterparts. By fifth grade, there were no differences in rate of problem solving between any of the groups.

These data, then, indicate that the pattern of responses for Type A and Type B subjects varies markedly from grade 3 to grade 5. Possible explanations for this finding are discussed later.

Measures of Knowledge About Time

Short Time Estimation Scale

An analysis of variance examined sex (2), grade (2), subject type (2), and STES subscales (3: short (A), medium (B), and long (C) periods of time) with repeated measures on the STES subscales. The dependent variable was the amount of time children thought the activities took. A significant sex effect was found, F (1,82) = 4.71, $p < .05$, with females averaging a score of 110.20 points on each of the subscales (total Likert scores) and males averaging 100.53 points. Standard deviations on these scales ranged from 28 to 31 points. The higher the score on these scales, the greater the amount of time the children expect will be required to accomplish the tasks on the scales.

In addition, a significant subscale x sex interaction, F (2,104) = 3.09, $p < .05$, and a significant subscale x grade interaction, F (2,104) = 3.84, $p < .05$, were found. Further analyses of the subscale x sex interaction using t-tests indicated that males' scores did not differ significantly from subscale to subscale. Females' scores did not differ from the males' scores on the STES subscale A, but females scored significantly higher (estimated longer times) than males on both the STES subscale B, t (88) = 3.03, $p < .01$, and the STES subscale C, t (88) = 2.47, $p < .02$. Figure 2 demonstrates these results.

Further t-tests examined the subscale x grade interaction. A significant difference in STES subscale A

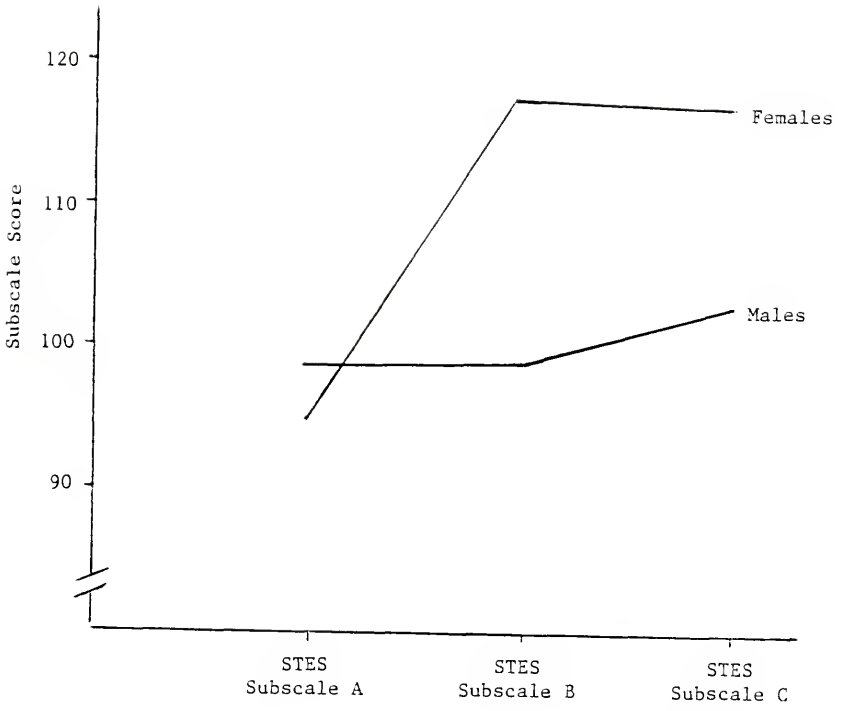


Figure 2. Sex Differences on the STES Subscales

scores were found between third and fifth graders, t (88) = 3.05, $p < .01$. Third graders averaged 86.07 on the subscale, while fifth graders averaged 105.57, indicating that fifth graders expected tasks to take longer to complete than third graders. No grade differences were found on either STES subscale B or C. This relationship may be seen in Figure 3.

A second ANOVA typing subjects as Type A or Type B on the basis of their impatience/aggression factor score again found a significant subscale x sex interaction reflecting the same pattern of results as discussed for the previous ANOVA. Since no interaction terms involving type reached significance, no further analyses were conducted on this data.

Estimated Duration of STES

An ANOVA examining subject type (2), sex (2), and grade (2) on the estimated amount of time required to complete the STES was conducted. The results indicated a significant grade effect, F (1,83) = 9.41, $p < .01$. Third graders estimated an average time of 21.39 minutes, and fifth graders estimated an average time of 13.42 minutes. While no exact time was noted while administering the scales (an effect of type of subjects within each grade was the anticipated effect), the third grade administration actually took slightly less time than the fifth grade administration, adding further credence to the effect.

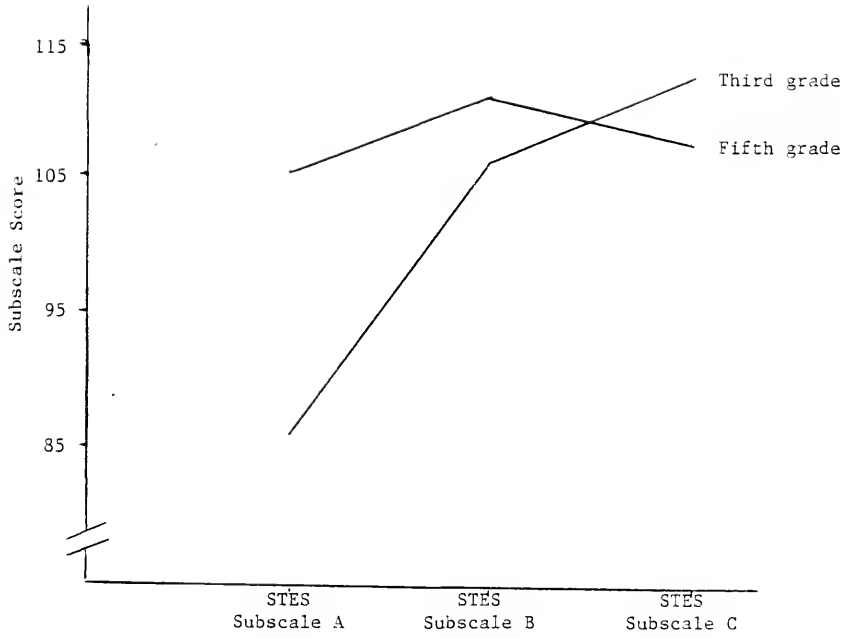


Figure 3. Grade Differences on the STES Subscales

The same single significant effect was found when Type A/B was determined by the score on the impatience/aggression factor on the MYTH. No other effects were noted.

Predictors of the Type A Behavior Pattern

A SAS RSQUARE procedure, performing all possible regressions of all variables for MYTH scores was completed to examine which variable or combination of variables best predicted MYTH scores. The results indicate that the best single predictor of MYTH scores is sex, providing an R^2 of .045, i.e., 4.5 percent of the variance in MYTH scores is accounted for by sex. The best two factor predictor term was sex and time estimation in the paced-slow math condition, $R^2 = .10$. The best three factor prediction term was sex, time estimation in the paced-slow math condition, and the time estimation in the first "blank" condition, $R^2 = .12$. Finally, the best four variable prediction term was found to be sex and time estimation in the first "blank" condition, paced-slow math condition, and the last "blank" condition, $R^2 = .145$. These low R^2 values were rather disappointing, accounting for little of the variability observed in the MYTH scores.

The same procedure was used to determine the best predictors for the subjects' impatience/aggression factor score. Again, R^2 values were low, with the best four factor predictor term being sex, time estimation in the first and

last "blank" trials, and the number of problems attempted in the unpaced-no stress math conditions, R^2 = .157.

These analyses were then run separately for each grade, resulting in somewhat better R^2 values and revealing some interesting differences in predictor variables.

Third grade MYTH scores were best predicted by sex, R^2 = .09. A four variable predictor combination including sex, time estimation in the paced-slow math condition, and the first and last "blank" conditions accounted for 23.8 percent of the variance. Prediction of the impatience/aggression factor score, however, was best predicted by a four variable combination of sex, time estimation in the unpaced-no stress and unpaced-stress verbal conditions, and the number of problems attempted in the unpaced-no stress math condition, R^2 = .313.

The fifth grade data indicated somewhat different predictor variables. The MYTH scores were best predicted by a four factor combination of sex, time estimation in the first "blank" condition, number of problems attempted in the unpaced-no stress math condition, and scores on the STES subscale A, R^2 = .29. When predicting the impatience/aggression score, the predictors changed very little, this time including sex, time estimated on the first "blank" trial, STES subscale A score, and the estimated duration of the STES, resulting in an R^2 of .33.

In viewing the data, it appears that prediction of the MYTH or factor score changes from a predominance of the

unpaced condition time estimation tasks in third grade to the "blank" conditions in the fifth grade. This possibility is discussed at greater length later.

Finally, a series of SAS RSQUARE procedures were utilized to determine whether differences in time estimation performance between the paced-slow and paced-fast conditions or unpaced-no stress and unpaced-stress conditions would serve as useful predictors of either total MYTH scores or scores on the impatience/aggression factor. Therefore sex, difference in paced-slow and paced-fast condition, and difference between unpaced-stress and unpaced-no stress were entered as predictor variables for both the MYTH scores and the impatience/aggression factor score. This procedure was followed for all subjects' data combined, and separately for each grade.

When all subjects' data were combined, the total of the three variables only accounted for 9 percent of the variance in MYTH scores, and 8 percent of the variance in the factor scores. These same factors accounted for 8 percent of the variance in MYTH scores and almost 10 percent of the variance in factor scores for fifth graders.

Prediction of the third graders' MYTH scores was somewhat better, with 17 percent of the variance accounted for by the three variables. Fourteen percent of the variability of factor scores was accounted for by these factors for the third graders.

In general, then, differences between these conditions in time estimation performance in these conditions are not

very predictive of either MYTH or factor scores for either grade, although prediction was slightly better for third graders than for fifth graders. Additionally, the increase in the amount of variance accounted for when each grade was examined separately may simply be a result of the decrease in the number of subjects and the large number of predictor variables. This may indicate that the R^2 values are at chance level. Caution is therefore needed in interpretation of these results.

DISCUSSION

As expected, significant sex differences were found for MYTH scores, with females being scored significantly lower (less Type A) than males. This replicates Matthews and Angulo's (1980) report of early standardization data for the MYTH. This finding could also have been expected since sex differences are commonly found on tasks related to components of the MYTH, e.g., competitiveness and aggression.

The data of primary interest in this study are the time estimation differences between Type A and Type B children on the various behavioral tasks. Earlier studies with adults and older children have indicated a consistent tendency for Type A individuals to overestimate the passing of time while engaged in various tasks. It was expected that the third and fifth graders in this study would perform in a like manner. The results of the present study fail to support the hypotheses.

The overall MYTH scores, or what may be referred to as the "general" Type A rating, did not reflect any Type A/B effect or interaction. When the impatience/aggression factor of the MYTH, which involves the time related questions, was utilized for the classification of "factor"

Type A and Type B behavior, a type effect, included in a trial x sex x type interaction, emerged. The follow-up analyses, however, revealed no significant differences between Type A and Type B subjects in the time estimation performance during any of the behavioral tasks.

An unexpected finding was that the amount of time which actually passed while the Type A males estimated the lapse of one minute was less in the unpaced-no stress than the unpaced-stress condition. This effect may be due to an increase in the amount of effort expended by Type A subjects under stress, although that pattern of behavior is usually associated with Type B subjects. At this age, then, this particular aspect of Type A behavior may not be fully involved.

Two characteristics of the data provide support for the view that time estimation abilities may not be developed sufficiently at this age to provide a reliable measure. First, there was a large variability in time estimation scores. The degree of variability declined from third to fifth grade, suggesting that individual differences in time estimation ability are not as great in the older children. In addition, as reported earlier, there was a tendency for all groups in all task-involved time estimation trials to underestimate the passage of time. Earlier studies with older subjects report that Type A subjects tend to overestimate time relative to Type B subjects, who tend to underestimate the passage of time when involved in various

tasks. That all groups in this study were markedly inaccurate in their time estimation, i.e., underestimation on the "filled" trials and overestimation on the "blank" trials, further supports the argument that time estimation abilities may be too immature insubjects at this age to be used as a reliable measure.

A second explanation for the observed pattern of results may be that children at the ages examined have difficulty performing two tasks concurrently. The behavioral task trials required subjects to estimate the passage of time and to either read stories and sentences or solve math problems. It was noted by both experimenters that some children seemed to forget about the time estimation aspect of the task and became engrossed in the reading or math performance. This occurred despite attempts during the instructions to emphasize the importance of the time estimation aspect of the task. This inability to simultaneously deal with two task requirements may account for some of the variability in the scores discussed above. In the "blank" trials in which there were no task requirements except for time estimation, all groups overestimated the passage of time, and the performance of all groups differed significantly between the "blank" trials and all of the task-involved trials. This further supports the possibility that the children encountered difficulty in dealing with two tasks simultaneously. Even in the "blank" conditions, however, no Type A/B differences were noted.

A number of studies have suggested that Type A individuals work at their peak level of performance regardless of the degree of stress placed on their performance. This tendency to consistently work at a rapid rate even in the absence of explicit stress is a major characteristic of Type A adults. Type B individuals, on the other hand, work at a somewhat slower rate unless under stress, when they increase their rate of performance to approximately match the Type A individuals' level. It was expected that children in this study would parallel the data on adults. This hypothesis was partially supported by the present study. When Type A/B was determined using the subjects' scores on the impatience/aggression factor of the MYTH, fifth grade Type A subjects attempted approximately the same number of problems under both the stress and no stress conditions. Type B fifth graders, however, tended to attempt more problems in the stress than the no stress condition. Thus, for the fifth grade children, the data indicate that children reflect the same tendencies present in older children and adults.

Third grade children, however, showed a reversal of this trend, with Type A children attempting more problems in the stress than the no stress condition. Type B children attempted the same number of problems under both conditions. This (reversed) effect was unexpected, and may reflect either a genuine relationship between these factors, opposite to that found in older subjects, or may be a chance

or random effect. If, as suggested earlier, the time estimation ability of children is relatively immature at this age, becoming increasingly accurate or consistent by fifth and later grades, this instability may affect the number of items attempted while estimating the passing of time.

Replication of this procedure is certainly warranted. If these results are reproduced, a serious re-evaluation of the time related aspects of the MYTH would be required. The items on the MYTH were selected specifically to reflect the behavioral characteristics commonly noted in Type A adults. This procedure assumed that equivalent behaviors in both young children and older adults have the same meaning or implications. If the reversed trend noted in this study for young elementary school children is replicated by future research, a reconsideration of that assumption will be necessary.

A second major purpose of this study was to test Ornstein's theory of time estimation. Briefly stated, Ornstein (1969) has proposed that our estimation of time duration is a direct function of the amount and complexity of information processed over a given period of time. The more information and/or the greater the complexity of information that we process in a given period of time, the greater the perceived length of time. In the present study, a comparison of time estimation abilities between the paced-slow and paced-fast conditions was used to test this theory.

If Ornstein is correct, the time estimation scores, i.e., actual elapsed time when the subject perceives the passage of one minute, in the paced-slow condition (six multiplication problems or six sentences presented in a one minute period) should be higher than in the paced-fast condition (twelve problems or sentences of similar difficulty presented in a one minute period). This would occur because less information is processed over time in the paced-slow condition. The results indicate that the hypothesis is correct, but only for Type B subjects. Type A subjects' time estimation scores did not differ between the two conditions.

The results suggest that Type B subjects are more sensitive to changes in rate of processing than Type A subjects. If it is assumed that time estimation abilities are a major component to Type A behavior in children, these results may take on added significance. If Type A subjects somehow differ in their ability to perceive the passing of time, perhaps not adapting their perception to the rate of information processing, their overall sense of time may be affected. One might assume that rate of processing normally is a useful tool for time estimation. If this ability is immature or ineffective in Type A subjects, their perception of time may be altered on occasion.

One important way in which the method of the present study differs from that of Ornstein is suggested when one compares the present study with one by Wolf et al. (1982).

Wolf and his associates report that fifth and sixth grade Type A and Type B children averaged 55.3 and 59.2 seconds, respectively, when estimating the passage of one minute while sorting marbles. The time estimation in the unpaced-no stress condition in the present study (the condition most similar to the Wolf et al. procedure) ranged from 78 to 86 seconds. The difference between these average estimates is striking. As mentioned earlier, both experimenters noted that a number of children seemed to become very involved in the task, whether reading or mathematics. In fact, several children commented, either just before or just after the trial ended, that they had forgotten to tell the experimenter when one minute had passed. The reading materials suggested by the teachers were taken from children-oriented readers. The stories, which involved an Indian boy, a sea going cabin boy, a Mexican boy going into the city for the first time, and a girl and her mother confronting a bear, were interesting to the children. The math problems were relatively easy, but required concentration. The interest in the materials, noted in both the third and fifth grade, may explain the differences in time estimation a) between the "blank" trials and any of the task-filled trials, b) between the present study and Wolf et al.'s study, and c) between the present study and Ornstein's work.

Wolf et al. had children sort marbles by color. This would seem to be a relatively undemanding task, possibly

even boring for fifth and sixth graders, but not as boring as the "blank" trials in the present study. It is noteworthy, therefore, that the time estimation scores for Wolf et al.'s study fall in between the "blank" and "filled" trials in the present study. Adult studies have also tended to use relatively uninteresting material such as journal articles for the "filler" material. For most undergraduates, such reading would not be highly involving or interesting.

If the information being processed is highly interesting, Ornstein's theory may not apply as it seems to when the information is not interesting. A common example may make this point more clear. When involved in a very good book or movie, time seems to pass slowly, often amazing readers or movie-goers when they find out how much time has really passed. During this time, according to Ornstein, the rate of information processing should determine the perceived duration. If the individual is engrossed in the book or movie, we might assume that his or her rate of processing and the complexity of the information being processed has actually increased. If this is true, Ornstein's theory would predict that movies or good books would seem to be much longer than they really are. However, the opposite is true--time seems to go by very slowly, i.e., one might think he has been reading for an hour when it has actually been two hours.

In summary, time estimation in the task-oriented conditions in this study may be longer than those found by

other researchers as a result of the interest levels of the materials used in the tasks. Certainly additional research is required to determine a) whether the time estimation effects described in this study are reliable, b) how such (mis)perception may influence autonomic arousal, and (c) whether manipulation of the type of interval "filler" task influences time estimation. Such procedures will serve to clarify the potential physiological effects of differences in time estimation abilities.

The Short Time Estimation Scale (STES) was developed by the author to examine differences between Type A and Type B children's perspective time estimation abilities. Many of the questions were adapted from a scale developed by Dodd and his associates (e.g., Dodd, Griswold, Burd, & Smith, 1983) for use with learning disabled children. In order to produce a scale capable of detecting relatively small differences in time estimation, fairly extensive changes were made, both to questions included in the scale, and in format (from multiple choice with correct/incorrect answers to a Likert scale with no specific "correct" answers). Two possible results were considered.

First, it was proposed that Type A children might be more accurate in time estimation as a result of being more time conscious than their Type B counterparts. If true, it would be expected that Type A children would achieve lower scores on the STES because Type A children, in fact, do things more quickly than Type B children (e.g., walk and

eat). Therefore their expected time requirements for various tasks should be shorter.

A second possibility, however, was that Type A children would actually score higher on the STES. This hypothesis presupposes that a time estimation inaccuracy in Type A children would lead them to believe that various tasks take longer than they really do. This in turn would combine with their high level of achievement motivation to produce the observed faster paced behaviors in an attempt to achieve a goal in what they perceive to be a reasonable period of time. The purpose of the STES was to determine which of these hypotheses would be supported.

The results failed to support either hypothesis. No Type A/B effects were noted on any of the subscales or the total scale. Rather, an unexpected sex effect was found. This effect occurred in the STES subscales B and C, and in the total scale. Females scored 18 points higher than males on STES subscale B (σ = 30.6) and 14 points higher on STES subscale C (σ = 27.8). This indicates that the sex difference applies to time estimation in the larger units of time tested. Items in STES subscale A in which no sex differences were found were scored in a range of 0 to 30 seconds. Items in STES subscales B and C include items rated in intervals of 0 to 6 minutes and 0 to 60 minutes, respectively.

Since the items on the scales have no "correct" responses, this sex effect cannot be examined in the context

of relative accuracy. The difference may simply reflect a real sex difference in how quickly children complete various tasks. For example, girls may take longer than males to eat, make their bed, ride their bike around the block, or get dressed in the morning.

An examination of the amount of time the children estimated they took to complete the STES revealed only a grade effect. Since the exact time spent completing the STES was not recorded, evaluation of this grade effect is problematic. In future research the actual time spent administering this scale should be noted.

The use of the SAS RSQUARE procedure suggests two major conclusions. First, Type A/B behavior does not seem to be as easily, or as clearly, predicted by time estimation abilities in children in third or fifth grades as for older children or adults. As discussed, children at this age may not have a fully developed sense of time or time estimation. The differences in predictor variables between third and fifth grades make it clear that there is no simple relationship between time estimation and Type A/B behavior in elementary school children.

When each grade was examined separately, the amount of variability on both the full MYTH score and the MYTH impatience/aggression factor accounted for by the dependent variables increased markedly, although not to as high a level as had been expected. Most interesting were the differences in the variables which best predicted the MYTH

or factor scores in the two grades. The third grade analyses reflected a dominance of the task-oriented behavioral time estimation scores, particularly the unpaced time estimation scores. For the fifth graders, however, a noticeable increase in the presence of the "blank" time estimation trials as predictors occurred in the analyses. The first "blank" trial was included in every three or four variable predictor model, and along with sex (which was included automatically in every model) provided the best two factor predictor model. This changing pattern suggests that the relationship between time estimation abilities and Type A/B behavior changes in the elementary school years.

The results of the present study suggest several avenues of future research, which may be followed sequentially or simultaneously. First, the changing nature of the relationship between Type A/B and time related performance indicates the need for the use of a longitudinal approach, following children from at least the third grade into adolescence. Such a design, using repeated measures, should provide a much clearer indication of the developmental pattern of children's time estimation abilities as well as the relationship between those abilities and Type A/B behavior. The present study suggests that with increasing age, time estimation ability scores reflect fewer individual differences. However, without more knowledge of what occurs before third grade and after fifth grade, we have only an incomplete picture of the

developmental process. Such longitudinal procedures will insure that observed age differences are developmental in nature, and not due to cohort effects. Most importantly, however, following individuals from childhood into their 40's and 50's will provide evidence for the predictive validity of the MYTH.

The relatively weak relationship between Type A/B as measured by the MYTH and time estimation performance also suggests the need for closer examination of the assumptions made by the MYTH, specifically, that the behaviors typical of the Type A adult are qualitatively the same in Type A children. If time estimation abilities are related to Type A behavior in adolescence and adulthood, but not in elementary school children, perhaps other components of the Type A behavior pattern such as competitiveness or hard-driving tendencies are also qualitatively different. The MYTH may prove to be a reliable measure of overall Type A/B in children, but the best behavioral assessments of coronary-proneness may be different for children and adults.

Another avenue of research to be pursued is to begin to use more physiological measures in research with children. Very few studies have examined any physiological correlates with Type A/B in children, and none have systematically examined serum lipid or cholesterol levels. Since it is through such physiological arousal that arterial or cardiac damage occurs, this seems the most logical "next step." Obvious problems exist with this approach, e.g., convincing

parents to allow blood samples to be drawn from their children for a "psychology experiment." Yet, until this research is completed, we cannot be sure of the stability of, or equality of, responses over a developmental span.

As discussed earlier, response times differed between Wolf et al. (1982) and the present study. Future research should manipulate the type of task used to fill the time estimation period. For example, trials may differ by using no task, an easy interesting task, an easy but boring task, a hard and interesting task, and hard and boring task. The results of such a study will greatly help subsequent research by outlining the effects of types of tasks used.

Finally, use of both the MYTH and an interview assessment for classification of children as Type A/B would be of tremendous value in providing further evidence of the validity of the MYTH. If a high level of agreement in classification of subjects as Type A or Type B is found between a structured interview and the MYTH, and particularly if both are related to physiological hyper-responsivity, we will be much more assured of the construct and predictive validity of our measures of Type A and Type B behavior.

APPENDIX A
PARENTAL CONSENT FORM

Dear Parent:

I am a doctoral candidate in developmental psychology at the University of Florida, conducting research on the development of health behaviors in children. I have been given permission by the Alachua County School Board and the Principal to conduct a research project at your child's school. Al Avendano will be assisting me on this project. We would like to ask for your help in completing this project.

Our research examines behavior patterns in children which some researchers and doctors have suggested may have an influence on their physical health as adults. If you agree, we will ask your child's teacher to complete a questionnaire on your child's overall behavior patterns. Your child then will be given a 25 minute test which looks at your child's concepts of time, for example: "How long does it take you to tie your shoes?". Finally, in individual sessions, your child will read several passages and solve several sets of math problems. This should take approximately 15 minutes. Your child will only participate when the teacher agrees that it will not disrupt his or her normal school work.

These procedures have been used before, and children usually seem to enjoy participating. We would greatly appreciate it if you would allow your child to participate. Your child may discontinue participation at any time and for any reason.

If you have any questions concerning this project, please feel free to contact me at home in the evenings at 373-0859, or you can leave a message to have me call you back at 392-0601. I will be happy to provide any information I can and to answer any questions you may have about the scales being used or the goals of the research. All information will be held in strictest confidence.

Thank you for taking time from your day to consider this request.

Sincerely,

Vernon F. Haynes, M.S.
Department of Psychology
University of Florida

I am willing to have my child participate YES / NO (please circle)

_____ _____

Signature of Parent Child's date of birth

_____ _____

Child's Name Child's Teacher/Grade

APPENDIX B
MATTHEWS YOUTH TEST FOR HEALTH (MYTH)
(Matthews & Angulo, 1980)

Name of child_____ Age_____

Rater_____ Subject No._____

This rating scale is designed to asaess various aspects of a child's behavior. Please mark how well the statement characterizes the child using the following scale:

1	2	3	4	5
extremely uncharacteristic	uncharacteristic	neutral	characteristic	extremely characteristic

1. When this child plays games, he/she is competitive.

1 2 3 4 5

2. This child works quickly and energetically rather than slowly and deliberately.

1 2 3 4 5

3. When this child has to wait for others, he/she becomes impatient.

1 2 3 4 5

4. This child does things in a hurry.

1 2 3 4 5

5. It takes a lot before this child gets angry at his/her peers.

1 2 3 4 5

6. This child interrupts others.

1 2 3 4 5

7. This child is a leader in various activities.

1 2 3 4 5

8. This child gets irritated easily.

1 2 3 4 5

9. He/she seems to perform better than usual when competing against others.

1 2 3 4 5

10. This child likes to argue or debate.

1 2 3 4 5

(PLEASE TURN OVER)

1	2	3	4	5
extremely uncharacteristic	uncharacteristic	neutral	characteristic	extremely characteristic

11. This child is patient when working with children slower than he/she is.

1 2 3 4 5

12. When working or playing, he/she tries to do better than other children.

1 2 3 4 5

13. This child can sit still long.

1 2 3 4 5

14. It is important to this child to win, rather than to have fun in games or schoolwork.

1 2 3 4 5

15. Other children look to this child for leadership.

1 2 3 4 5

16. This child is competitive.

1 2 3 4 5

17. This child tends to get into fights.

1 2 3 4 5

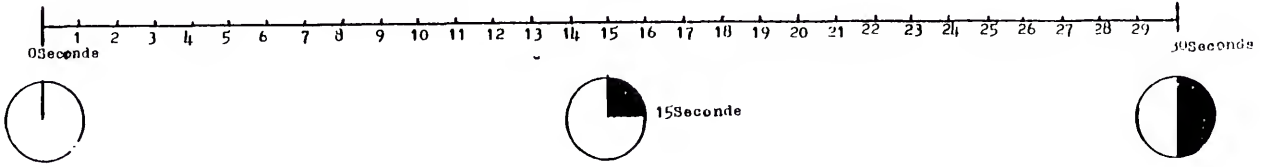
18. How confident are you of the above ratings?

1	2	3	4	5
extremely unconfident	unconfident	neutral	confident	extremely confident

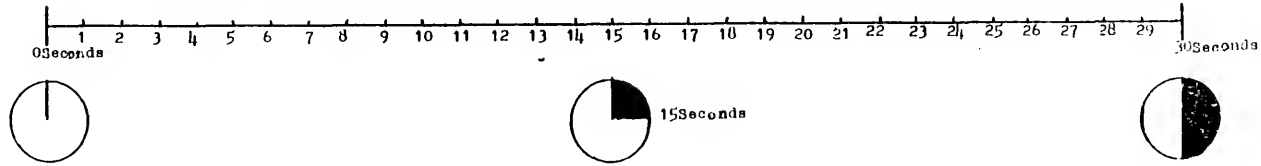
Thank you.

APPENDIX C
SHORT TIME ESTIMATION SCALE (STES)

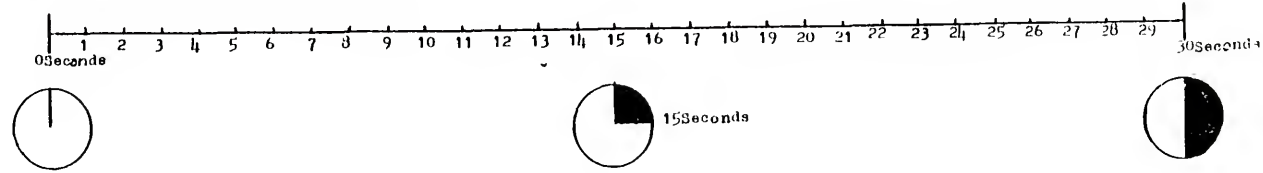
1. HOW LONG DOES IT TAKE YOU TO DIAL A TELEPHONE NUMBER?



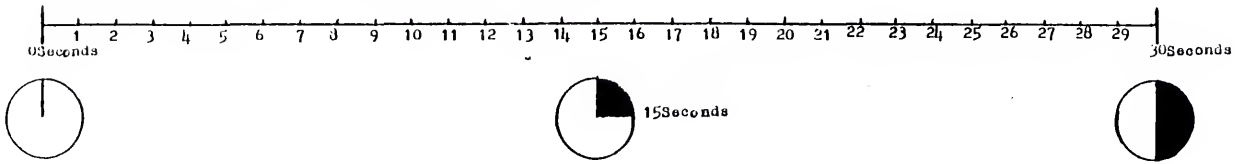
2. HOW LONG DOES IT TAKE YOU TO WRITE YOUR NAME AND ADDRESS ON AN ENVELOPE?



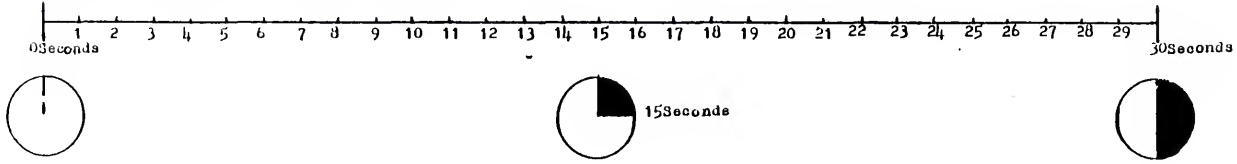
3. HOW LONG DOES IT TAKE YOU TO SHARPEN A PENCIL?



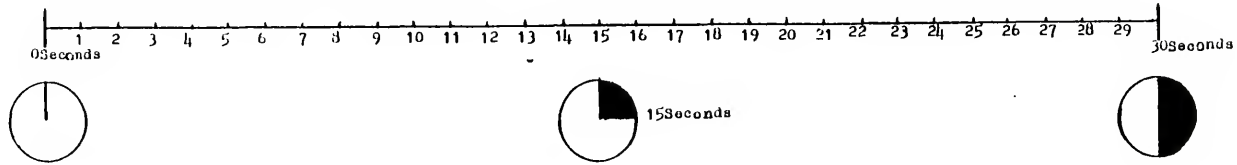
4. HOW LONG DOES IT TAKE YOU TO PUT YOUR JACKET ON AND BUTTON OR ZIP IT UP?



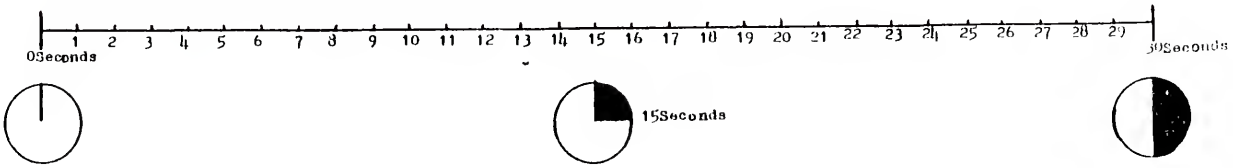
5. HOW LONG DOES IT TAKE YOU TO WRITE THE FULL NAME OF A PERSON?



6. HOW LONG DOES IT TAKE YOU TO WASH AND DRY YOUR HANDS?

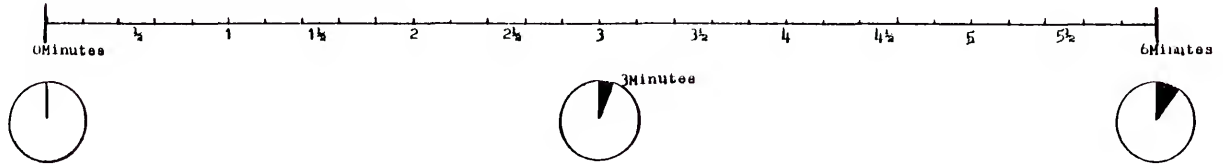


7. HOW LONG DOES IT TAKE FOR THE PICTURE TO COME ON AFTER A TELEVISION SET IS TURNED ON?

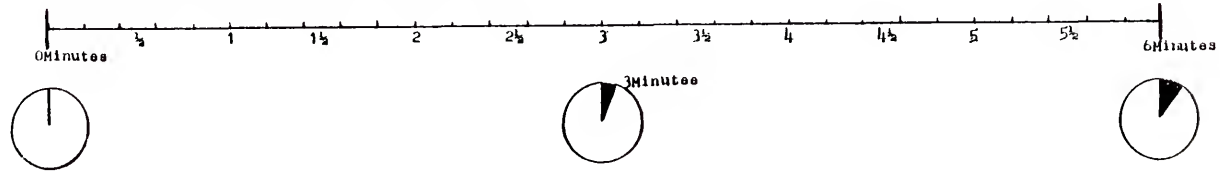


S T O P !!! Do not continue until you are instructed to do so.

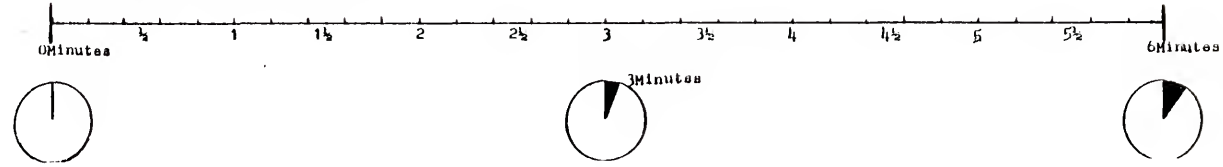
8. HOW LONG DOES IT TAKE YOU TO BRUSH YOUR TEETH?



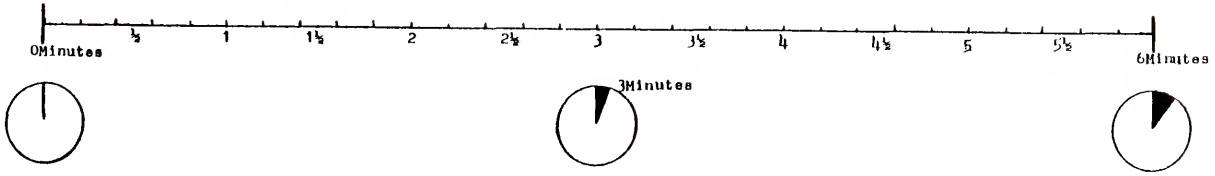
9. HOW LONG DOES IT TAKE YOU TO WALK TO THE LUNCH ROOM FOR LUNCH?



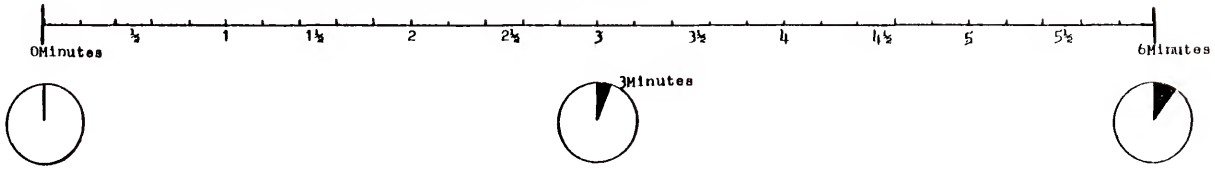
10. HOW LONG DOES IT TAKE YOU TO EAT A CANDY BAR?



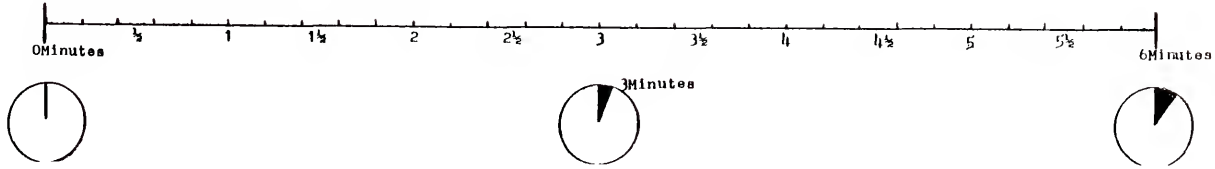
11.HOW LONG DOES IT TAKE YOU TO NEATLY MAKE YOUR BED?



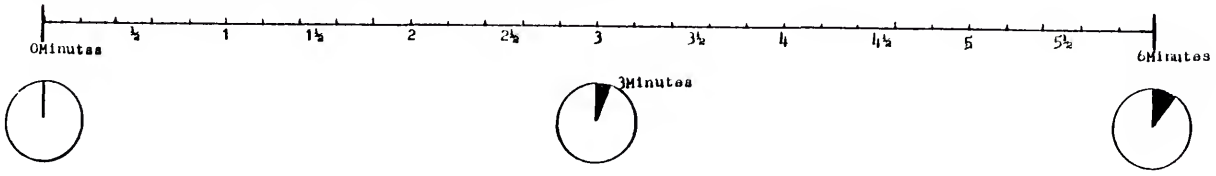
12.HOW LONG ALTOGETHER ARE THE COMMERCIALS ON TELEVISION BETWEEN TV SHOWS AT NIGHT?



13. HOW LONG IS A STOPLIGHT RED BEFORE IT TURNS GREEN?

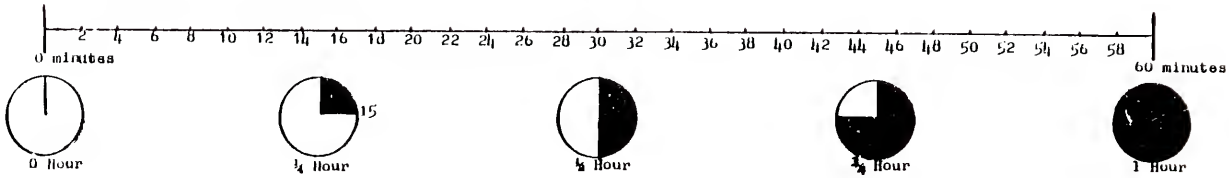


14. HOW LONG DOES IT TAKE YOU TO RIDE YOUR BIKE AROUND THE BLOCK WITHOUT STOPPING?

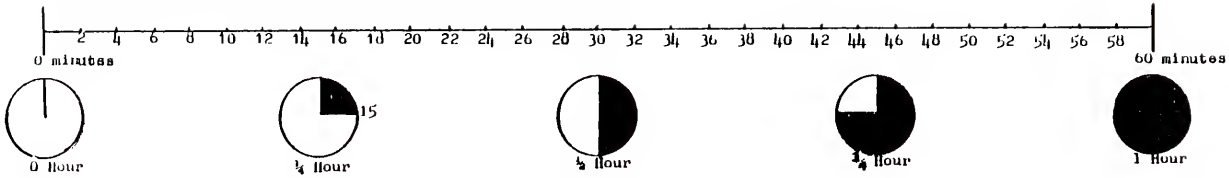


S T O P !!! Do not continue until you are instructed to do so.

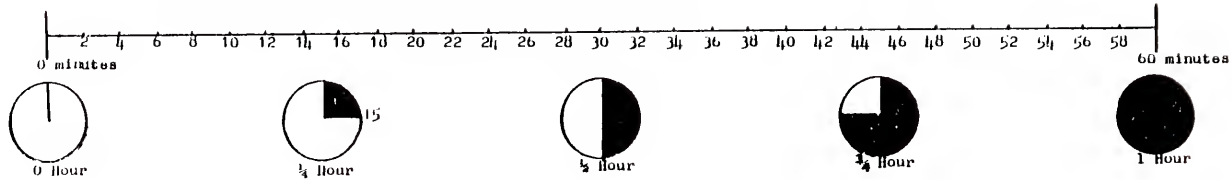
15. HOW LONG DOES IT TAKE TO EAT A HAMBURGER?



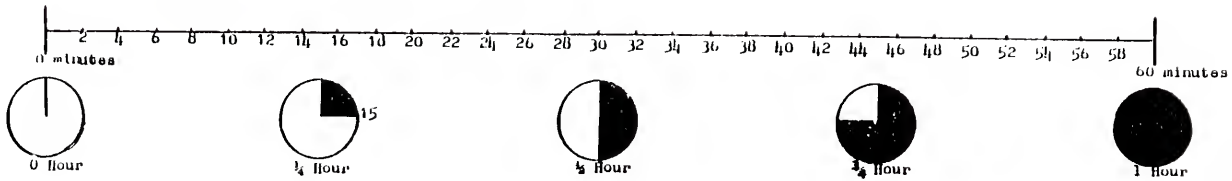
16. HOW LONG DOES IT TAKE YOU TO WATCH THE EVENING NEWS, WEATHER, AND SPORTS SHOW?



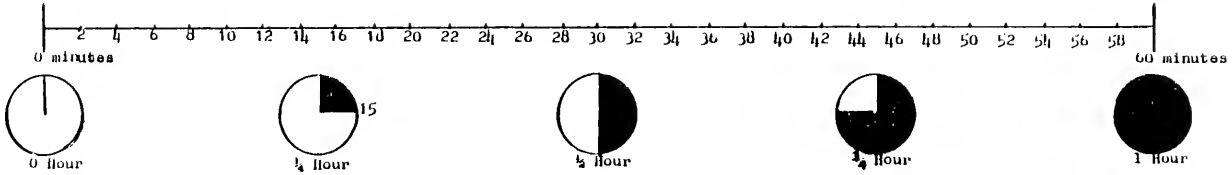
17. IF YOU DON'T COUNT THE COMMERCIALS, HOW MANY MINUTES DOES A ONE HOUR TV PROGRAM LAST?



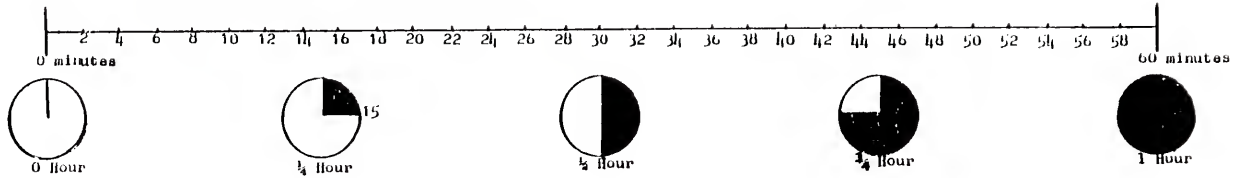
18. HOW LONG DOES IT TAKE TO READ ALL OF THE SUNDAY NEWSPAPER COMICS?



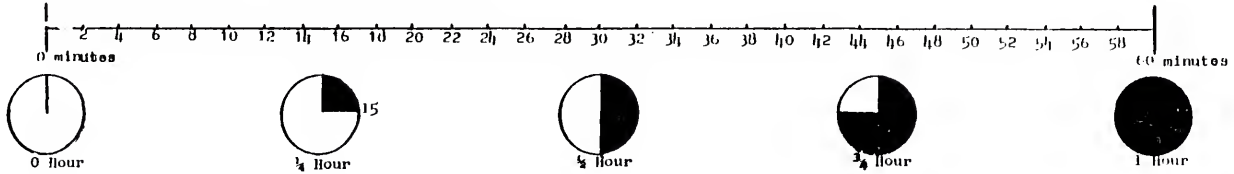
19. HOW LONG DOES IT TAKE YOU TO GET DRESSED?



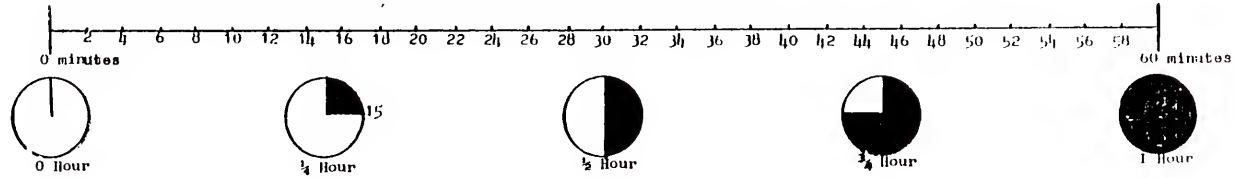
20. HOW LONG DOES IT TAKE YOU TO LISTEN TO ALL OF A ROCK OR SOUL ALBUM?



21. HOW LONG ARE CHILDREN OUT OF THE CLASSROOM AT LUNCH TIME?



22. HOW LONG DOES IT USUALLY TAKE TO WAIT IN LINE AND THEN GET CHECKED OUT OF THE GROCERY STORE?



HOW LONG DO YOU THINK YOU HAVE SPENT COMPLETING THIS SCALE?

APPENDIX D
MULTIPLICATION PROBLEMS UTILIZED IN THE UNPACED MATHEMATICS CONDITION

NAME_____ GRADE_____ S#_____ DATE_____

CIRCLE: STRESS/NOSTRESS

5 x 7 = _____	1 x 9 = _____	7 x 6 = _____
3 x 6 = _____	6 x 6 = _____	5 x 5 = _____
4 x 2 = _____	2 x 3 = _____	3 x 3 = _____
9 x 3 = _____	4 x 5 = _____	8 x 4 = _____
2 x 6 = _____	9 x 6 = _____	0 x 8 = _____
4 x 4 = _____	6 x 5 = _____	8 x 7 = _____
1 x 4 = _____	7 x 9 = _____	9 x 5 = _____
6 x 3 = _____	2 x 8 = _____	1 x 7 = _____
5 x 8 = _____	8 x 9 = _____	7 x 4 = _____
3 x 4 = _____	0 x 4 = _____	9 x 2 = _____
2 x 4 = _____	4 x 9 = _____	8 x 3 = _____
3 x 8 = _____	1 x 6 = _____	5 x 9 = _____
7 x 7 = _____	6 x 8 = _____	0 x 7 = _____
9 x 8 = _____	7 x 8 = _____	3 x 9 = _____
2 x 9 = _____	1 x 2 = _____	8 x 8 = _____
4 x 7 = _____	5 x 3 = _____	6 x 9 = _____
8 x 0 = _____	2 x 7 = _____	4 x 8 = _____
7 x 5 = _____	9 x 9 = _____	6 x 7 = _____
5 x 6 = _____	3 x 7 = _____	1 x 8 = _____
0 x 6 = _____	9 x 4 = _____	7 x 3 = _____
3 x 5 = _____	4 x 6 = _____	5 x 4 = _____
2 x 5 = _____	1 x 5 = _____	6 x 2 = _____
8 x 6 = _____	0 x 9 = _____	9 x 7 = _____

APPENDIX E
EXAMPLES OF MULTIPLICATION PROBLEMS USED IN THE PACED CONDITIONS

$$\begin{array}{r} 9 \\ \times 1 \\ \hline \end{array} \qquad \begin{array}{r} 8 \\ \times 5 \\ \hline \end{array}$$

APPENDIX F
EXAMPLES OF SENTENCES UTILIZED IN THE PACED CONDITIONS

The phone rang ten times.

The dark forest was scary.

APPENDIX G
COUNTERBALANCING SCHEDULE FOR BEHAVIORAL MEASURES

"Blank"	Unpaced-Nostress	Unpaced-Stress	"Blank"
	Paced-VI-10	Paced-VI-5	"Blank"
"Blank"	Unpaced-Stress	Unpaced-Nostress	"Blank"
	Paced-VI-5	Paced-VI-10	"Blank"
"Blank"	Paced-VI-10	Paced-VI-5	"Blank"
	Unpaced-Nostress	Unpaced-Stress	"Blank"
"Blank"	Paced-VI-5	Paced-VI-10	"Blank"
	Unpaced-Stress	Unpaced-Nostress	"Blank"

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BIOGRAPHICAL SKETCH

In 1956 the world saw conservative Dwight Eisenhower elected president of the United States, the Soviet army invade Hungary to crush the "freedom fighters" there, and the birth of Vernon Haynes. Today, Reagan is President, the Russians are still in control of Hungary, and Vern is about to receive a Ph.D.

Between 1956 and 1984 Vern has gone to school, moved to Europe, gone to school, moved back to the United States, gone to school, enlisted in the Air Force, gone to school, abandoned earlier career goals (law), gone to school, done a lot of diving in the Florida Keys, gone to school, finished a marathon, gone to school, and has become sick and tired of going to school. So he has taken a job. Where? At a school, where else?

Plus que ça change plus que les choses restent le même.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Patricia H. Miller, Chairperson
Associate Professor of
Psychology

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

W. Keith Berg
Associate Professor of
Psychology

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

William J. Froming
Associate Professor of
Psychology

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

James J. Algina
Associate Professor of
Foundations of Education

This dissertation was submitted to the Graduate Faculty of the Department of Psychology in the College of Liberal Arts and Sciences and to the Graduate School, and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

August 1984

Dean for Graduate Studies
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